AUSTRALIAN
DEFENCE FORCE

The Defence Explosive Ordnance Publication 101

CONTENTS

SECTION 5 – LICENSING FOR EXPLOSIVES

INTRODUCTION

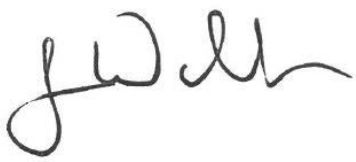
General Overview

1.1 DEOP 101 – *Department of Defence Explosives Regulations*, is issued on the authority of the Commander Joint Logistics of the Department of Defence, pursuant of that appointment's responsibility to establish explosive ordnance safety principles and policies for use by all elements of the Australian Defence Organisation.

1.2 This manual provides those principles and policies in 6 sections for the storage, transport and handling[1] of explosive ordnance.

1.3 This manual is based essentially upon the principles prescribed in various North Atlantic Treaty Organisation manuals of Safety Principles for Military Ammunition and Explosives, and the United Kingdom Explosives Storage and Transport Committee Series JSP 482. Some Australian only approved changes, including changes to the Quantity Distance Tables in Regulation 5 which resulted from the Joint Australian/United Kingdom Stack Fragmentation Trials, have also been incorporated.

1.4 Requests for guidance in the use of, or proposals to correct anomalies in, this manual are to be directed to the Directorate of Ordnance Safety at explosive.storageandtransport@defence.gov.au.



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Sponsor

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[1] For the purpose of this manual, 'handling' has the same meaning as in the Explosives Act 1961 i.e. 'handling' includes loading, unloading, discharging, stacking, stowing, storing, transporting and any operation incidental to, or arising out of, any of those operations.

SCOPE

1.1 This manual prescribes the regulations, principles, standards and procedures for the management and safety of explosive ordnance activities in Defence.

1.2 These regulations are intended to reduce the hazards inherent in all explosive ordnance activities. However, provision cannot be made to cover every conceivable emergency situation. Accordingly, personnel associated with explosive ordnance activities must understand the principles on which they are based, so that, under circumstances not specifically covered, appropriate action will be taken. The prescribed safety regulations and their associated procedures are minimum requirements compatible with the safety of personnel and the safeguarding of property.

1.3 The regulations in this manual specify quantity distance criteria for permanent and temporary explosive ordnance activities, and a degree of regulation of explosive ordnance materiel to accord with sound risk management practice. The prescribed quantity distances and the regulatory requirements do not guarantee absolute immunity from the risks of propagation of explosions, damage to property or injury to personnel: to do so would be impracticable and uneconomical. The risk inherent in these regulations represents a reasonable compromise between absolute safety and practical considerations of cost and operational efficiency.

1.4 Although the regulations are concerned essentially with the safety aspects of explosive ordnance, certain other items of equipment have a direct bearing on that safety. Any interface between explosive ordnance and items such as ordnance, small arms, test or handling equipment, packaging and associated Dangerous Goods must therefore be controlled to ensure that the safety of the explosive ordnance is not compromised. The enclosed regulations relating to non-explosive items are concerned solely with their serviceability and use which have a direct bearing on the safety of the explosive ordnance used with them. They should be read in conjunction with other relevant documentation covering such equipment.

1.5 There will be occasions when cogent economic or operational considerations, usually of a temporary nature, will warrant the acceptance of a greater risk to life and property. Nevertheless, inability to comply with mandatory requirements will necessitate specific deviations as appropriate. Procedures for seeking deviations or for the granting or refusal of such deviations by the appropriate authorities are prescribed at regulation 1.2.

Applicability

1.6 The regulations in this manual are issued for the guidance and direction of all personnel who are concerned with the management, supervision, conduct and audit of the following activities:

a. The acceptance, storage, transport, handling, inspection, maintenance, use and disposal of explosive ordnance.

b. The siting and construction of explosive ordnance facilities such as storage, preparation, maintenance and inspection of buildings and loading areas.

c. The siting of facilities not directly associated with an explosive ordnance function but which, if inappropriately located, would be exposed to hazards from nearby explosive ordnance or which, by their function, would increase the hazard to nearby explosive ordnance.

1.7 This manual has been prepared for use by personnel who have appropriate training, qualifications, experience and demonstrated competence to undertake a wide range of explosive ordnance activities.

Organisation of the Department of Defence Explosives Regulations

1.8 The regulations, principles, standards and procedures in the Department of Defence Explosives Regulations comprise the following:

a. Preliminary Pages

b. Section 1 – Principal Regulations

c. Section 2 – Classification of Explosives

d. Section 3 – Transport of Explosives

e. Section 4 – Storage and Handling of Explosives

f. Section 5 – Licensing for Explosives

g. Section 6 – Design Criteria for Explosives Facilities

Use of this Manual

1.9 These regulations have drawn significantly from policy provisions of DEFLOGMAN, Part 2, Volume 9, Chapter 2 and should be read in conjunction with them.

1.10 Application of these Regulations. This manual applies to all Defence Force personnel and Defence Civilian employees during peacetime and contingency operations, whether operating within Australia or overseas. When Australian Defence Force units operate from foreign countries the more stringent of the requirements of this manual or the Explosives Instructions of the host nation, are to be applied. When Defence personnel are operating in a Joint Military Force or a United Nation's Peacekeeping Force, they may be required to comply with other Explosive Ordnance instructions to achieve unity of activity. However, the principles prescribed in this manual should be referred to in the first instance. Visiting Forces must comply, as a minimum, with these instructions in regard to safety requirements, for example, application of Quantity Distances. This manual also applies to explosive ordnance Services Providers where this requirement is specified in the contracts between Defence and the Services Providers.

1.11 Supplementary Instructions. The issue of supplementary instructions to cover circumstances where safety requirements are judged inadequate, or are considered to be necessary but have not been provided by this manual, is a basic responsibility of Officers-in-Charge who are to take the necessary action to control the hazard. Such local orders and instructions are not to depart in any way from the mandatory policy, should conform as closely as possible to the advisory procedures and, when appropriate, should accord with the principles explained in these regulations.

1.12 Conflicting Instructions. Officers-in-Charge are to inform the Sponsor of this manual of any circumstances (other than those covered by existing approved deviations) which conflict with these regulations. Where there is doubt as to the exact meaning of any policy, or it appears that a change to the policy is necessary, a request for an interpretation or change is also to be made to the Sponsor. Interim measures designed to provide optimum safety are to be at the discretion of the Officer-in-Charge until the interpretation is clarified.

Rules of Interpretation

1.13 In these regulations, unless the content requires otherwise:

a. Words importing the singular include the plural,

b. Words importing the plural include the singular,

c. Words importing the masculine gender include the feminine.

1.14 In these regulations the word:

a. MUST indicates a technical requirement which is vital for the safety of the depot and/or EO and the avoidance of a catastrophe,

b. IS TO/ARE TO indicates a mandatory instruction,

c. SHOULD indicates an (advisory) safety requirement which is important but not essential,

d. MAY/CAN indicates optional courses of action and possibilities,

e. IS/ARE indicates a fact or valid technique.

Definitions

1.15 Definitions of terms commonly used in conjunction with explosive ordnance and associated operations are contained in the ‘Glossary of Terms’. They are intended to reduce ambiguity and to provide a degree of uniformity of description and interpretation of information throughout this manual.

ROLES AND RESPONSIBILITIES

Introduction

1.1 The formulation of policy for, and the management and conduct of, Explosive Ordnance (EO) functions within the Department of Defence demands clear definitions of responsibilities for such functions. These responsibilities must be defined within the approved Defence command and control structure to facilitate the provision of safe and serviceable EO in support of defence force operations.

Purpose

1.2 The information contained in this chapter describes approved responsibilities for explosive safety at the managerial, supervisory and operator levels, generic to all EO activities throughout Defence. For EO activities governed by the regulations throughout this manual, activity specific responsibilities are embedded with each regulation.

1.3 The responsibilities detailed in this instruction are in addition to those the those prescribed in DEFLOGMAN Chapters;

a. Part 2 Volume 9 Chapter 1; and

b. Part 2 Volume 9 Chapter 2.

ORGANISATIONAL RESPONSIBILITIES

Vice Chief of Defence Force Group

1.4 The Office of the Vice-Chief of the Defence Force (VCDF) is responsible for delivering timely and responsive Defence advice on affordable options for current and future Defence capability in order to deliver cost effective Defence outputs. VCDF through the Capability Systems Division manages the development of future Defence capabilities through sponsoring and developing capability proposals. These capability proposals are prepared within the directorates of Maritime, Land and Aerospace Development. Many capability proposals invariably include weapons systems and the items of EO which are elements of those systems.

1.5 **Capability Systems Division.** Head Capability Systems (HCS) is responsible to VCDF for managing the development of future Australian Defence Force (ADF) capabilities through sponsoring and developing capability proposals for each Service through individual Development Branches.

1.6 **Maritime, Land and Aerospace Development Branches.** The Directors General Maritime, Land and Aerospace Development branches are responsible to HCS for coordination and development of sea, land and air combat capabilities through interpretation of the military implications of strategic guidance, long-term plans and capability analysis and sponsorship of individual capability development proposals by: supporting capability studies; producing capability proposals in accordance with capability analysis plans and capability development priorities; sponsoring projects for combat and support capabilities; sponsoring research and development; and liaising with Service Headquarters, Scientific Advisers and the Acquisition Executive as required. Responsibilities include the determination in broad terms, of potential resources and costs of EO safety during consideration of capability options involving systems likely to contain EO, eg allowance of 12 months for safety testing, budgeting for additional missiles for safety testing purposes. As capability options are narrowed and the system is progressively defined, so are the EO safety requirements defined.

Australian Theatre

1.7 The Australian Theatre (AST) has been established as the Area of Operations for the ADF. Essentially there is no particular geographic area because the ADF has been traditionally involved wherever required. This potentially covers a very wide arena, and it will vary as situations change, but operations in the theatre will invariably be joint operations from an ADF perspective. The ADF may conduct operations with our traditional allies (COMBINED OPERATIONS), with aligned nations

(COALITION OPERATIONS), or with the United Nations (UN OPERATIONS). All are ADF 'theatre' operations.

1.8 **Commander Australian Theatre.** The appointed permanent theatre commander is the Commander, Australian Theatre (COMAST), and is supported by his headquarters for the theatre (HQAST).

1.9 **Command.** COMAST command is exercised through the Commander's Component Commanders, who are principal advisers to COMAST, as well as being commanders in their own right, with significant single Service responsibilities. In AST the components are:

a. Naval Component (all of Maritime Command),

b. Land Component (all of Land Command),

c. Air Component (all of Air Command), and

d. Special Forces Component.

Enabling Executives

1.10 The role of Enabling Executives is to provide enabling services to the output executives, through purchase-provider arrangements.

Joint Logistics Command

1.11 Joint Logistics Command (JLC) is responsible for planning for the provision of materiel support to ADF operations and exercises, for translating the operations plans developed by the strategic (ADFHQ) and operational (HQAST) plans staff and providing guidance to JLC business units on the sustainment of forces.

1.12 The functions of the JLC include:

a. planning, coordinating and managing logistic support to ADF operations;

b. managing EO and guided weapons, fuel and lubricants, combat rations, clothing and other consumable items;

c. managing ADF strategic warehousing and distribution;

d. developing joint logistic policy and doctrine;

e. developing and managing logistic process and systems and sponsoring joint logistic capability; and

f. technical regulation of explosives storage and distribution.

1.13 During contingencies, the Commander Joint Logistics (CJLOG) may be made directly responsible to the Chief of the Defence Force.

Explosive Ordnance Branch

1.14 Explosive Ordnance Branch (EOB) responsibilities include:

a. the maintenance of an effective and comprehensive EO safety regime;

b. the provision of EO proof, test and evaluation services;

c. efficient EO logistics management;

d. whole-of-Defence EO governance; and

e. managing the implementation of recommendations from both the Review of Defence Policy & Procedures for the Management of Explosive Ordnance, and the Weapons, Munitions and Explosives (WME) Security Performance Audit.

Directorate of Ordnance Safety

1.15 The Directorate of Ordnance Safety (DOS) is a Centre of Excellence for explosives safety. Requirements of EO for military use are fundamentally different from commercial variants. Consequently, the departmental requirements for the corporate governance of explosives safety consist of an independent body to assess explosives safety and fulfil the Commonwealth's duty of care. The assurance of the safety of EO intended for use by the ADF is at the core of DOS activities which are centred on two processes: assessment of safety and suitability for service; and, the technical regulation of safety principles for the storage, handling and distribution of EO. In accordance with DI(G)LOG 4-5-012 the Director, Ordnance Safety (OS) is the technical regulator of EO storage and transport activities within Defence.

1.16 **Safety and Suitability for Service.** Responsibilities regarding safety and suitability for service of Defence EO are contained in DI(G)LOG 1-4-006 and DEOP 102 – *Technical Integrity of Explosive Ordnance*

1.17 **Explosives Storage and Transport Committee.** The Explosives Storage and Transport Committee (ESTC) is a semi-autonomous committee of the DOS established to provide specialist advice to the Defence organisation and other departments and agencies as authorised, on the safety aspects of the storage and transport of Defence explosive ordnance (EO). The ESTC is responsible to the Director OS for routine matters. All major policy issues that involve a significant commitment of resources, or changes that would impact on the overall thrust of EO safety principles are to be referred to the Commander Joint Logistics.

1.18 **ESTC Secretariat.** The ESTC secretariat comprises a full-time Secretary who is responsible for the day-to-day management of ESTC activities and the maintenance of ESTC records.

1.19 **ESTC Membership.** Director OS as the technical regulator for storage, handling and transport of EO is Chair the ESTC. Membership of the ESTC consists of the Chairperson, Secretary ESTC and representatives from:

a. Australian Defence Headquarters, Headquarters 1st Joint Movement Group.

b. JLC -Directorate of EO Services.

c. Land Engineering Agency;

d. Defence Science and Technology Organisation, Weapons Systems Division.

e. Capability Development Group, Australian Defence Force Test and Evaluation Office.

f. Corporate Services and Infrastructure Group;

(1) Director Training Area Management; and

(2) Facilities Civil Engineering.

g. Joint Systems Division;

h. Thales Australia Limited;

i. Australian Industry;

j. State Chief Inspector Representative; and

k. University of New South Wales/Australian Defence Force Academy.

1.20 When appropriate, other authorities may be invited to attend ESTC meetings.

1.21 If necessary, legal advice is to be obtained through Defence Legal or through appropriate legal consultancies.

1.22 **Role of the ESTC.** The role of the ESTC is to:

a. develop policy, resolve conflict and interpret Defence policy for the storage, transport, handling and use of ammunition and explosives within Defence establishments and units including:

(1) matters concerning explosives risk management, licensing, explosives quantity distances and safeguarding for storage facilities;

(2) review applications for deviations;

(3) the siting, design, layout, construction and maintenance of explosives storage facilities, magazines, storehouses, laboratories and process buildings;

(4) the effects of explosions on people, property and other explosives;

(5) the explosives safety aspects of powered mechanical handling equipment.

b. classify, for storage and transport, and maintain a register of, all military explosive ordnance and commercial explosives and pyrotechnics used by the Australian Defence Force (ADF) and visiting forces;

c. liaise with the Australian Forum of Explosive Regulators, its drafting sub-committees and other relevant authorities, including the Explosives Storage and Transport Committee of the United Kingdom Ministry of Defence and the United States Department of Defense Explosives Safety Board, on matters relating to safe conveyance of military explosive ordnance by rail, road, sea or air;

d. recommend the conduct of relevant storage and transport explosives safety trials and evaluate the results;

e. deliberate on matters consistent with its function.

f. audit independent of the monitoring authorities within Defence Groups.

1.23 **ESTC Tasking.** Service directorates, DSTO establishments, Australian industry and other authorities requiring advice on explosives storage and transport matters should initially seek guidance from the Secretary ESTC. The Secretary ESTC will determine the most appropriate process/authority to address the matter. The ESTC may be tasked directly through the Director OS.

Directorate Explosive Ordnance Services

1.24 Directorate Explosive Ordnance Services (DEOS) is responsible for;

a. EO Technical Services; and

b. EO Storage and Distribution.

Directorate Explosive Ordnance Logistics Capability

1.25 Directorate Explosive Ordnance Logistics Capability (DEOLC) is responsible for;

a. EO Logistics Capability;

b. EO Facilities Planning and Delivery, and

c. EO Licensing and Risk Assessment.

Directorate Explosive Ordnance Governance

1.26 Directorate Explosive Ordnance Governance (DEOG) is responsible for;

a. Review and revision of policies related to EO management;

b. Development and implementation of an EO Assurance Framework to assess compliance with those policies;

c. Development and implementation of an effective EO management framework;

d. Identification and implementation of improved logistics controls;

e. Provide input into the maintenance and development of EO Information Management Systems; and

f. Influence the strategic direction of EO management via the Defence Explosive Ordnance Committee.

Joint Proof and Experimental Unit

1.27 Joint Proof and Experimental Unit (JPEU) is responsible to provides dynamic, static and environmental testing of component parts or complete systems of EO, non-EO and other items to support Defence and non-Defence clients. The unit consists of:

a. Headquarters at Defence Establishment Orchard Hills; and

b. Proof and Experimental Establishments at;

(1) Port Wakefield, SA; and

(2) Graytown, VIC. The Graytown facility commands a small arms test centre and a munitions test centre at Thales Australia Benalla facility.

CAPABILITY ACQUISITION AND SUSTAINMENT GROUP

1.28 EO acquisition and sustainment within the Capability Acquisition and Sustainment Group (CASG), is managed by the Explosives Materiel Branch.

NAVY

1.29 **Deputy Chief of Navy.** Deputy Chief of Navy (DCN) is responsible to Chief of Navy (CN) for: managing the Navy Headquarters and Executive Sub-Group; developing and coordinating Navy capability; providing strategic personnel, operational and training guidance; management doctrine and structure; overseeing Navy resource management as Group Budget Holder; developing national and international relations; overseeing security policy, Occupational Health and Safety; environmental management and the public relations/information plan; strategic resource planning and management; developing strategic plans for Navy Information Services.

1.30 **Director General Navy Capability, Performance and Plans.** Director General Navy Capability, Performance and Plans is responsible to DCN for the Navy Plan, Mobilisation Plan, Capability Output Guidance, Australian Defence Headquarters (ADFHQ) Capability Alignment, Cross Force Element Group Issues, point of contact for Force Element Groups and Maritime Development, Performance Management Framework, Group Performance Reporting in the following areas:

a. Defence Annual Report,

b. Portfolio Budget Statements (PBS), and

c. Billet Prerequisite Review.

1.31 The Naval Component. The Naval Component (of HQAST) is responsible for the planning and conduct of maritime operations. The Maritime Commander (MC) has directed that all personnel in Maritime Command are part of the component, and that some will be pre-designated as component staff, while the remainder will augment these personnel when and if required. The NCC is based around the permanent staff of the post-TNT MHQ Operations Division (Ops Div), supported by N0 Command staff, N1 Personnel staff, N4 Logistic staff and CSOW staff. The pre-designated component personnel are colloquially known as 'Naval Component' and will be collocated at HQAST.

1.32 Navy Systems Branch. The Director General Navy Systems Branch (DGNAVSYS) is responsible to the Commander Australian Navy Systems Command (CANSC) for the functions and roles of the Navy Systems Branch (NAVSYS). NAVSYS brings together Navy-unique platform, weapon and Command, Control, Communications, Computers, Intelligence, Surveillance, Reconnaissance and Electronic Warfare (C4ISREW) systems engineering into one organisation. It develops Navy's materiel requirements in these areas and ensures, as far as possible, that these requirements are met. It provides operational C4ISREW, Ranges and assessing support to the Fleet. It develops Professional Requirements for Engineering and Logistics, and provides Category Sponsorship for Engineering, Supply, CIS, EW and PHOT branches.

1.33 Chief Naval Engineer. The Director General Navy Systems Branch (DGNAVSYS) is the Chief Naval Engineer (CNE).

1.34 NAVSYS Functions and Roles. The NAVSYS functions and tasks are to:

a. support and service the Navy Force Element Groups (FEG) to enable them to meet the preparedness, mobilisation and capability requirements of extant strategic and operational guidance within assigned resources and in accordance with the CN Preparedness Directive (CNPD);

b. provide 'Centres of Excellence' to enable Navy to be an informed customer for cross-FEG systems engineering and integrated logistic support for C4ISREW systems, platform systems, propulsion and control systems, and combat, weapons, armament and sensor systems;

c. provide CIS, RANTEWSS and NAVCOMMSTA support to MC for operations;

d. contribute to test, evaluation, inspections, audits and performance assessment to ensure a safe working environment consistent with the effective delivery of Naval capability;

e. contribute to test, evaluation and performance assessment in support of transition and acceptance of new-platforms and systems into service, in consultation with FEG Commanders and as agreed by MC on operational issues;

f. identify current systems shortfalls and future requirements to contribute to future acquisition and workforce planning decisions to help shape the future force;

g. oversee specialisation and category sponsors appointed within the NAVSYS Branch to ensure that the development of professional requirements is undertaken with close consultation with the FEG sponsors, Heads of Specialisations and DGNPT; and

h. set standards and contribute to requirements for the delivery of engineering, logistics and other support services provided to Navy.

1.35 Directorate of Navy Weapons Systems. The Director Navy Weapons Systems (DNWS) is the Maritime TRA representative for all Weapons systems and also holds the following positions:

a. Chairman Under Water Weapons Review Group (UWWRG) Committee,

b. Chairman Above Water Weapons Review Group (AWWRG) Committee,

c. Chairman Radiation Safety (RADSAFE) Board, and

d. Chairman Armament Safety (ARMSAFE) Board.

1.36 **Assistant Director Armament.** Assistant Director Armament (ADARM) provides advice for the development and maintenance of RAN design requirements of weapons systems, EO, EO shipboard stowages (magazines), EO handling facilities and equipment, naval ordnance and small arms weapons.

1.37 ADARM is responsible for the following:

a. TRA representative for Armament Systems,

b. Armament System Integration, and

c. EO Engineer (EOE) Category Sponsor.

1.38 ADARM is also an executive or member of the following Boards/Committees:

a. Executive Director ARMSAFE Board, and

b. Explosives Environment Service Life Advisory Committee.

1.39 **Director General Navy Certification, Safety & Acceptance Agency.** The role of the Director General Navy Certification, Safety and Acceptance Agency (DGNCSA) is to support the effective delivery of Naval and combat capability by FEG's, through oversight and delivery of a regulatory and certification system that ensures the safety, fitness for purpose, materiel and operational integrity of naval capability. To achieve these outcomes DGNCSA is responsible to both DGNS and DCN for the following:

a. management and oversight of the RAN Safety program;

b. promulgation of whole of Navy regulatory and safety policy;

c. management of RAN operational and technical regulation, certification and audit;

d. oversight of the RAN Test Evaluation and Analysis Authority, including operational release of platforms and systems into Naval Service; and

e. liaison with Director General Technical Airworthiness on AIRSAFE and naval aviation regulation issues.

1.40 **RAN Test, Evaluation and Analysis Authority.** The RAN Test, Evaluation and Analysis Authority (RANTEAA) is a professional and independent authority for Operational Test and Evaluation (OT&E) of new and enhanced maritime capabilities for the Australian Defence Force, and is responsible for the development of a recommendation to the Chief of Navy, through the MC, for phased or full Operational Release of maritime capability.

1.41 RANTEAA was established on 1 July 1996 in response to Australian Government initiatives of self-reliance in Defence capability development and acquisition. The organisation evolved from the previous RANTAU and RANTEG organisations.

1.42 The Director (DRANTEAA) is a member of the RAN SHIPSAFE Committee and the International Test and Evaluation Association.

ARMY

1.43 **Deputy Chief of Army.** Deputy Chief of Army (DCA) is responsible to Chief of Army (CA) for coordinating and monitoring the implementation of Army policy, programs and administration by AHQ, Commands, Regions and Army staff overseas. He is also responsible to CA for the development and coordination of Army's Capability Development.

1.44 Director General Future Land Warfare - Army. The role of Director General Future Land Warfare – Army (DGFLW-A) is to support CA in defining and realising the Army of the future. The responsibilities of DGFLW-A regarding EO are general in nature and arise in the following areas:

a. Development of Capstone concepts to guide the development of Army capabilities involving EO; and

b. Management of the Army Continuous Modernisation Plan (ACMP).

1.45 Director Concepts and Capability Development - Army. Director Concepts and Capability Development - Army (DCCD-A) is responsible to DGFLW-A for the development of concepts that influence the development of future Army and ADF capabilities. DCCD-A involvement with EO is general in nature and primarily directed towards the early stages of projects involving the future acquisition of EO to meet land capabilities. This responsibility involves:

a. Informing the capability development process to maximise future land force capability; and

b. Preparation of Army principals for participation in capability development fora, in particular the Defence Committee (DC) and the Defence Capability and Investment Committee (DCIC).

1.46 Director General Preparedness and Plans - Army. Director General Preparedness and Plans - Army (DGPPA) advises CA in the command and strategic management of the Army in the areas of force structure, preparedness and mobilisation, materiel policy security and information management matters. DGPP-A prepares CA, as principal land warfare adviser to Chief of the Defence Force (CDF) in preparation, development and command of the ADF, including mobilisation, materiel and logistic policy, capability resourcing, and current and planned operational commitments. Materiel and logistic policy is developed to govern the types, quantities, safety and management by Army of land EO.

1.47 Directorate of Technical Regulation - Army. The role of Director Technical Regulation – Army (DTR-A), through DGPP-A, is to regulate land materiel technical integrity assurance processes on behalf of CA. Land materiel implicitly includes EO intended for use by land forces. DTR-A specific responsibilities are:

a. Development, implementation and management of the Army Technical Regulatory Framework (TRF).

b. Delegation of technical authority, and accreditation of engineering organisations.

c. TRF compliance audits.

d. Liaison and cooperative development of policy with other TRA.

e. Sponsorship within Army of policy matters relating to the technical integrity of land materiel.

1.48 DTR-A ensures compliance with the Army TRF through technical instructions, containing regulations and guidance, promulgated in the Technical Regulation of Army Materiel Manual (TRAMM). The Army TRF is supported by a means of evaluating and improving performance based upon a compliance audit system. Amongst other matters, the TRAMM specifically addresses safety assurance of land materiel.

1.49 Furthermore, the TRF defines explicit responsibilities for decisions being taken on EO engineering, procurement and maintenance aspects by the following authorities:

a. **Executive Authority.** Executive authority applies to authorised individuals undertaking decisions involving the commitment of resources. Such authorities are:

(1) Commanders by virtue of their command appointment, and

(2) Individuals delegated or appointed to exercise financial authority (referred to as Procurement Authorities).

Compliance by executive authorities with the TRF includes the requirement to obtain and adhere to comprehensive technical advice relating to the technical integrity of land materiel. It is particularly important for executive authorities to note that decisions taken that are not in full compliance with the TRF or contrary to technical advice, are entirely the responsibility of the executive authority.

b. **Technical Authority.** Technical integrity depends upon competent technical decisions and recommendations being offered by technical authority to executive authority. The appointed Design Acceptance Authority (DAA) as per the TRAMM, Volume 2, Section 1, Chapter 3 delegated technical authority.

1.50 Directorate of Materiel Policy - Army. The role of Director Materiel Policy – Army (DMP-A), through DGPP-A, is to advise CA on the development and management of the material and logistics policy required to sustain Army and Defence capabilities. The responsibilities of DMP-A with respect to EO are as follows:

a. Within the Army Program they include:

(1) Development of Army logistic, materiel and policy to support Army capabilities involving EO systems;

(2) Provision of logistic, materiel and equipment policy input into the formulation of Army plans, projects and studies;

(3) Coordination of Integrated Logistic Support (ILS) concepts to support Army's capabilities;

(4) Conduct of Life of Type (LOT) reviews; and

(5) Monitoring the Five-Year Minor Capital Equipment Program (FYMCEP).

b. Within the Defence Portfolio they include:

(1) Participation in the AHQ contribution to ADHQ plans and policy development for logistic, materiel and equipment related issues;

(2) On-going liaison with Joint and supporting logistic agencies to ensure that their support accords with Army expectations and contributes to satisfying Army capabilities; and

(3) Active participation in ADHQ logistic, materiel and equipment forums.

Land Component

1.51 Land Headquarters. Land Headquarters (LHQ), commanded by the Land Commander (LCAUST) is responsible to CA for the operational readiness, training, development and maintenance of Land Force formations and units. Implicit in this role is the requirement to ensure that EO accepted into service by Land Command (LCOMD-A) formations and units is safe and fit for service, maintained and used in accordance with the appropriate instructions by trained and competent personnel. Specifically, LCAUST has the follow responsibilities pertaining to EO safety:

a. Examine future operational concepts leading to improvement of EO materiel capabilities as required.

b. Provide input to EO acquisition programs, including the operational environment under which the EO is to be maintained and used.

c. Sponsoring and undertaking, as appropriate, studies and trials involving EO for the purposes of examining or assisting the development of a current or proposed LCOMD-A capability.

d. Ensuring that all aspects of EO safety are adhered to throughout LCOMD in accordance with the Army Safety Management System (ASMS).

e. Management of EO resource allocations to LCOMD units to meet both training needs and projected operational requirements.

1.52 LCOMD Formations and Units. Commanders of LCOMD formations and units are responsible to LCAUST for:

a. ensuring that members under their command are trained and competent to undertake activities involving EO systems, in accordance with extant policy and instructions;

b. ensuring that EO systems employed during training and operations have a current Capability Certification from AHQ;

c. ensuring that EO systems are properly maintained in accordance with extant instructions governing the maintenance of such systems; and

d. Reporting any safety incidents involving EO systems.

Training Command

1.53 Headquarters Training Command - Army. Headquarters Training Command - Army (TC-A), commanded by COMD TC-A, is responsible to CA for the provision of doctrine, individual training and education and input to force development options. In relation to EO, COMD TC-A is responsible for:

a. informing the capability development process of the resource liability necessary for ensuring that projected training needs of both operational and logistic personnel are recognised early in the new EO acquisition process;

b. representing COMD TC-A during the acquisition stage of EO projects to ensure that EO safety training requirements, including facilities, are developed and funded accordingly, prior to acceptance of the subject EO into service by CA;

c. development and initiation of training methodologies and processes leading to the enhancement of EO safety training throughout the Command;

d. management of production and promulgation of EO safety training requirements and resources to the Command; and

e. ensuring that any matters affecting safety of EO notified to Army are analysed for amendment of extant training doctrine and notified to Command units accordingly.

1.54 Training Command Units. Commanders of units under command of TC-A with a training responsibility for EO are responsible to COMD TC-A for ensuring that:

a. EO safety training methodologies are maintained in accordance with current HQTC-A doctrine, policy and instructions;

b. Instructional staff are trained and competent to undertake training of personnel in EO subjects;

c. Personnel undertaking training at TC-A units in EO subjects are not deemed by the unit as qualified in that subject unless meeting all mandated EO safety objectives;

d. EO and associated weapon systems used in training courses, have a current Capability Certification from AHQ.

e. EO systems are properly maintained in accordance with extant instructions governing the maintenance of such systems; and

f. Reporting any safety incidents involving EO systems during training activities.

CASG - Land Systems Division

1.55 The role of Land Systems Division (LSD) is to acquire and provide through-life support for designated land systems for the ADF. This role includes EO weapon systems. This role includes the responsibility for ensuring that EO acquired by LSD meets all safety requirements and processes detailed in this manual and in particular, DEOP 102, prior to acceptance into service by CA. LSD comprises four Branches, those of whom have responsibilities for EO safety are discussed below:

a. **Land Manoeuvre Systems Branch.** Land Manoeuvre Systems Branch (LMSB) is responsible for capabilities involving tracked and wheeled manoeuvre systems, mobility systems and armament systems. Responsibilities for EO within LMSB are primarily concerned with Armaments, Tracked Manoeuvre and Wheeled Manoeuvre System Program Offices:

(1) **Armaments System Program Office.** Armaments System Program Office (ARMTSPO) is responsible for acquisition, through-life support and disposal of weapons systems. This generally excludes EO, although ARMTSPO has a responsibility to ensure that weapons acquired by ARMTSPO are safe and suitable for service (S3) in the designated service environment, when firing EO designed for a particular weapon acquired and supported by ARMTSPO. Accordingly, ARMTSPO must work closely with the EO Procuring Agency to ensure that any weapon acquired is S3 when firing associated EO and conversely, the EO Procuring Agency must work closely with ARMTSPO to ensure that any new natures of EO are S3 when fired from weapons supported by ARMTSPO.

(2) **Tracked Manoeuvre System Program Office.** Tracked Manoeuvre System Program Office (TMSPO) is responsible for acquisition, through-life support and disposal of tracked vehicles, including any mounted armaments. Accordingly, TMSPO has a responsibility to ensure that tracked-vehicle mounted weapons acquired are S3 in the designated service environment, when firing EO designed for a particular weapon. TMSPO must work closely with the EO Procuring Agency to ensure that any weapon acquired is S3 when firing associated EO and conversely, the EO Procuring Agency must work closely with TMSPO to ensure that any new natures of EO are S3 when fired from weapons supported by TMSPO.

(3) **Wheeled Manoeuvre System Program Office.** Wheeled Manoeuvre System Program Office (WMSPO) is responsible for acquisition, through-life support and disposal of wheeled vehicles, including any mounted armaments. Accordingly, WMSPO has a responsibility to ensure that wheeled-vehicle mounted weapons acquired are S3 in the designated service environment, when firing EO designed for a particular weapon. WMSPO must work closely with the EO Procuring Agency to ensure that any weapon acquired is S3 when firing associated EO and conversely, the EO Procuring Agency must work closely with WMSPO to ensure that any new natures of EO are S3 when fired from weapons supported by WMSPO.

b. **Land Close Combat Systems Branch.** Land Close Combat Systems Branch (LCCSB) is responsible for capabilities involving engineer, soldier combat support, surveillance, electrical and simulation systems, and ground based air defence systems. Responsibilities for EO safety are discussed below:

(1) **Engineer Systems Program Office.** Engineer Systems Program Office (ENGSPO) is responsible for ensuring that any engineer equipment acquired that includes EO in its operation safe is when functioning the relevant EO. ENGSPO must ensure that EO acquired by the EO Procuring Agency for

operation in the systems acquired and supported by ENGSPO, have been assessed as S3 for the engineer equipment concerned. Examples may include such devices as mine-clearing equipment using explosive charges and equipment used for demolitions such as electric firing devices.

(2) **Soldier Combat Support Systems Program Office.** Where Soldier Combat Support Systems Program Office (SCSSPO) introduces equipment employed by the soldier involving EO, SCSSPO must ensure that the equipment introduced in conjunction with the EO is S3.

(3) **Surveillance, Electrical and Simulation System Program Office.** Although Surveillance, Electrical and Simulation System Program Office (SESSPO) involvement with EO may be limited, SESSPO may be introducing electrical devices for use with EO (such as remote firing systems) or as part of some simulation system. Accordingly, SESSPO must ensure that if any such systems are intended for use with a particular nature of EO, the subject system in association with the EO is S3 in its intended operating environment.

(4) **Ground Based Air Defence and Radar Systems Program Office.** Ground Based Air Defence and Radar Systems Program Office (GBADRSPO) is responsible for ensuring that any air defence weapons system intended for acquisition is assessed as S3. Post acceptance by the capability manager, GBADRSPO is responsible for ensuring that should either the service environment within which the system is employed be changed or that the system configuration be changed, then the original S3 assessment is re-evaluated.

c. **Land Engineering Agency.** Land Engineering Agency (LEA) is responsible for providing systems, logistic and specialist engineering support to the ADF. This support is focused towards ensuring the technical integrity of land materiel and to ensure that such materiel is safe and fit for its intended purpose. LEA's responsibility and focus is particularly applicable to engineering support provided with respect to EO and associated systems. Such support includes evaluation of EO safety. LEA's Fire Support Systems (FSS) Program is responsible for provision of such engineering support as follows:

(1) FSS expertise includes:

(a) Large calibre systems,

(b) GBAD and missile systems,

(c) Small Arms (SA) systems,

(d) Electro-Explosive Hazards (EEH), and

(e) Ballistics performance and range safety of explosive systems (including determination of Weapon Danger Areas (WDA)).

(2) With respect to EO safety, FSS:

(a) Undertakes and reports on design safety evaluations of EO as requested by SPOs or the Directorate of Ordnance Safety (DOS) in the course of Safety Case development;

(b) Undertakes and reports on dynamic safety testing of EO and associated weapon systems (eg. F88 IW and specified cartridges) in support of developmental activity, the acquisition process or incident/defect investigation; and

(c) Acquires and maintains data and other technical information pertaining to the safety of EO and associated weapons systems.

AIR FORCE

1.56 Chief of Air Force. Chief of Air Force (CAF) is the Commander of the Royal Australian Air Force and is responsible, inter alia, for all EO related activities in Air Force (AF).

1.57 Director General Capability Planning – Air Force (DGCP-AF). DGCP is responsible for the raise, train and sustain in-service capabilities through the coordination of Fundamental Inputs to Capability (FIC).

1.58 Director General Technical Airworthiness – ADF (DGTA-ADF). DGTA-AF is the ADF Technical Airworthiness Regulator (ADF TAR) and the ADF Technical Regulatory Authority for Defence EO (ADF TRA-EO).

1.59 Deputy Director Explosive Ordnance Policy and Planning – Air Force (DDEOPP-AF). DDEOPP-AF is responsible for developing Air Force policy, plans and requirements for EO, providing specialist strategic EO advice in support of Air Force capabilities, and providing specialist advice to weapons trade and category sponsors. DDEOPP-AF reports to Director General Logistics – Air Force (DGLOG-AF) through the Directorate of Technical Capability – Air Force (DTC-AF).

1.60 Director of Capability Support - Air Command (DCS-AC). DSC-AC is responsible for the major functions within Air Command that provide support and governance over our major capabilities, including the oversight of all logistics systems and logistics governance; and for managing policy and doctrine within Air Command, including Standing Instructions, Air Command manuals and doctrine. DCS-AC reports to Air Commander Chief of Staff (COS).

1.61 Deputy Director Weapons – Air Command (DDWEAP-AC). DDWEP-AC is responsible for management of EO allocations; provision of Air Command EO governance; control of air weapons ranges; and providing capability management guidance for weapons systems. DDWEAP-AC reports to Air Commander Chief of Staff (COS) through the Director of Capability Management (DCM-AC).

1.62 Aircraft Stores Compatibility Engineering Squadron (ASCENG SQN). ASCENG SQN is a part of the Development and Test Wing (DTWG), Aerospace Operational Support Group (AOSG). DTWG is the Australian Defence Force (ADF) service provider to Air Force and Army for specialised flight test and evaluation (encompassing flight test planning, engineering and development, and conduct), and aviation medicine training and testing and policy. ASCENG SQN is the service provider to Air Force, Army and Navy for aircraft stores compatibility testing and clearance.

1.63 Aircraft stores compatibility is the ability of each element of specified aircraft stores configuration(s) to coexist without unacceptable effects upon the physical, aerodynamic, structural, electrical, electromagnetic or functional characteristics of each other under all expected ground and flight conditions. CO ASCENG SQN, as Senior Design Engineer is responsible through OC DTWG for the provision of ASC Flight Clearances (approved designs) and design advice for aircraft stores capability required for all state aircraft IAW AAP 7001.053, Technical Airworthiness Management Manual. In addition to ASC Flight Clearances, ASCENG produces store load procedures, conducts static rig and ground armament test and develops weapon safety templates for air launched ballistic and guided weapons. CO ASCENG SQN is also the Airworthiness Standards Representative (ASR), acting on behalf of DGTA to prescribe, revise and interpret relevant aircraft stores compatibility airworthiness standards.

1.64 Aircraft Stores Compatibility activities are conducted throughout the life cycle of the capability from Operational Requirements Definition, Test and Evaluation (Developmental, Acceptance and Operational), introduction into service and maintaining established operational capabilities.

1.65 Base Armament Manager (BAM). The position known as the BAM provides the coordination and management of all Base armament-related activities by utilising the various armament specialists that exist on a Base. A detailed overview of their role is available in DI(AF) LOG 16-13 and AC SI(LOG) 3-56.

1.66 Line Safety Controllers. DI (AF) LOG 16-12—Management of Explosive Ordnance Activities in the Royal Australian Air Force requires EO loading and unloading operations to be conducted under the supervision of line safety controllers (LSC). The roles and responsibilities for LSC are outlined in AAP 7001.059 ADF Aviation Maintenance Management Manual.

1.67 **Squadron Armament Officers.** Squadron (SQN) Armament Officers (ARMO) are responsible for managing day to day SQN EO operations and for providing specialist advice to the CO or SENGO, as required, on any aspects of those activities. Additionally, ARMO are to ensure that SQN EO activities are only performed at appropriately licensed facilities/areas and by personnel trained, assessed and authorised as competent to undertake those activities.

SCIENCE AND TECHNOLOGY GROUP

1.68 The Science and Technology (S&T) Group is an owner support group within the Defence Portfolio. The group manager is the Chief Defence Scientist (CDS). The S&T Group is the official Defence Portfolio Group covering the Defence Science and Technology Group (DSTG).

1.69 The role of DSTG is to ensure expert, innovative and impartial application of S&T to the defence of Australia and its national interests. DSTG is tasked by non-DSTG Defence groups to carry out research primarily for, and on behalf of Defence. Such research tasks may include EO and associated weapons systems.

RESPONSIBILITIES FOR SAFETY

General

1.70 All personnel who manage, supervise or work with or near EO must bear in mind that these items are designed to explode and, therefore, are potentially hazardous. Even the least sensitive EO, if subjected to imprudent or improper handling, may initiate and so injure personnel and damage property. The history of accidents involving EO shows that avoidable circumstances existed in almost every instance where the cause could be determined. Some guiding principles for personnel planning EO activities follow. Observance of these principles will reduce the possibility of EO accidents:

a. Expose the minimum number of personnel to the minimum amount of EO for the minimum period of time.

b. Understanding of and adherence to prescribed safety instructions are essential.

c. Constant alertness and intelligent close supervision will eliminate carelessness in routine work.

d. The individual output of personnel is not to be evaluated on a competitive basis to a degree that degrades safety.

e. Report any unsafe practices and equipment.

Defence Group Headquarters

1.71 Defence Group Headquarters are to ensure that the explosives instructions contained in this manual are implemented throughout their establishments and units through the issue of implementation instructions as necessary and the periodical audit of activities.

Responsibilities of Officers-In-Charge (OIC)

1.72 In addition to the duties and responsibilities inherent in their positions, OIC of establishments/units or specific EO activities, are responsible for:

a. explosives safety on their establishment, unit, fighting platform or during any activities for which they have command responsibility;

b. ensuring the qualification and authorisation of personnel under their command who perform or supervise EO operations;

c. requiring personnel of other agencies, including contractors, while on the facility under their command, to conduct their activities in accordance with established safety requirements;

d. enforcing the mandatory requirements of these instructions and be guided by the advisory provisions; and

e. initiating those directives and inspections necessary to effect compliance with these instructions.

1.73 The absence of a safety requirement in this publication, or in the references cited, does not necessarily indicate that safeguards are not required. Where no existing safety instructions apply, or where a deviation from an established mandatory safety requirement is desired, the OIC must submit through appropriate channels full particulars and detailed plans for approval. In the interim, OIC are to take the action necessary to control the hazard.

1.74 At Royal Australian Navy commissioned establishments, to assist Commanding Officers (CO) in discharging their responsibilities, CO are to appoint Explosives Custodian Officers who are to have, but are not limited to, the following responsibilities:

a. the provisioning, receipting, dispatching, transportation, storage and safe custody of EO;

b. facilitating the storage, transport and handling of EO at authorised sites;

c. the preparation, conduct and monitoring of routine musters, stock control reports, EO Restrictions and Reclassification action, defect, malfunction and accident reporting;

d. the safe conduct of all EO activities performed at the establishment and by ship's company outside the establishment as part of their duties; and

e. the preparation and issue of supplementary instructions as considered necessary, to cover local conditions or to amplify the requirements of these instructions.

Supervisory Personnel

1.75 Supervisors are to be thoroughly familiar with the provisions of these instructions. Supervisors have no authority to waive or alter explosives instructions and any associated unit safety instructions nor are they to permit violation of such instructions by others. They are to act positively to eliminate any potential accident hazards existing in operations under their jurisdiction. Supervisors are to:

a. Explain to all subordinate operators the standard safety requirements, industrial hygiene safeguards and precautions that they must follow and enforce the observance of all safety instructions by each operator. Supervisors are to explain the characteristics of the EO and other dangerous articles involved; the selection, use and care of protective as well as process equipment; and the hazards of fire, explosion and other catastrophes which the safety instructions and industrial hygiene requirements are intended to eliminate or reduce.

b. Instruct and train subordinate operators in the work that they are to perform, whether the instruction is given directly or through experienced operators, until the supervisor is satisfied that the operator is capable of performing the work safely. This instruction is to include complete information concerning building and area exits and the location and use of shelters, first–aid kits, firefighting apparatus, machinery guards and personal protective equipment, deluge showers, plunges and neutralising solutions.

c. Report promptly to their immediate superior all operators who, in their opinion, are not competent for their assigned work.

d. Investigate or assist in the investigation of all accidents involving operations, equipment, or personnel under their supervision and report or assist in the preparation of the report on the results of the investigation to higher authority for appropriate action.

e. Identify all persons entering or approaching the building or area in the supervisor's charge and determine their authority to enter and/or remain in the area. Supervisors are to exercise their authority to require any person whose presence and/or actions are detrimental to safety, to vacate the building or area for which the supervisor is responsible.

f. Enforce orders relating to maximum number of personnel. When the total number of persons, including operators, supervisors, inspectors, and transients exceeds the number permitted in the room, the supervisor is to cease operations and inform the personnel not regularly employed in the building as to the excess number and the need for the excess number to vacate the room. If such notice is not effective in reducing the number of persons in the room or building to the number permitted, the supervisors are to suspend operations and promptly notify appropriate authorities.

g. Ensure that only permissible quantities of EO are held in the room or building before commencement of operations.

h. Permit the use of only those tools authorised for the operations in the manner as prescribed by standard operating procedures. Supervisors are to require that tools be properly stored in designated locations when not in use. When a tool is lost or misplaced in processing rooms or buildings, the supervisors are to stop operations until the tool is found or they are satisfied that it cannot become the source of additional hazard.

i. Maintain cleanliness of the operational area or building. Supervisors are to maintain all safeguards and prevent the blocking of safety exits, aisles, and accesses to fire–fighting equipment.

j. Disallow major repairs or changes in any building, machinery, or equipment in buildings containing hazardous materials except in accordance with specific instructions of the Officer–in–Charge or the Commanding Officer. Supervisors are to enforce the safety standards in buildings under repair in their area although the repair force may not be under their orders.

k. Enforce observance of the safety requirements concerning personnel protective clothing and equipment. Supervisors are to inspect and maintain, or cause to be maintained or replaced, goggles, gloves, gauntlets, gasmasks, aprons, helmets, safety uniforms, safety shoes, and such other implements, accessories, and appliances which are required for the safe performance of the work with which they are charged.

l. Alert their immediate supervisor of all areas where railings, footboards, lights, guards, hoods, automatic stops or safety appliances are needed or repairs are required, and all areas where sprays, showers, plunges, or shelters are desirable.

m. Report in writing to their CO or OIC requests, suggestions, comments as the supervisor may have, with regard to safety standards.

n. Alert his immediate supervisor of the need for EOD personnel to remove defective EO or materials from the work area.

o. Comply with all applicable publications in the performance of supervisor and Independent Inspector's checks of work being performed or completed.

Operating Personnel

1.76 Operating personnel are to understand and strictly observe all safety standards, requirements, and precautions applicable to their work or duty. In addition, individuals are to:

a. report to their supervisor any unsafe condition or any equipment or material that they considers unsafe,

b. warn others whom they believes to be endangered by known hazards or by failure to observe safety precautions,

c. wear approved protective clothing and use approved safety equipment when required,

d. report to their supervisor any injury or evidence of impaired health occurring in the course of work or duty, and

e. be prepared in the event of an unforeseen hazardous occurrence to exercise such reasonable caution as is appropriate to the situation.

FORMS AND LABELS

Introduction

1.1 The safety and efficiency of Explosive Ordnance (EO) activities depend largely on all processes, both technical and administrative, being conducted in a consistent and controlled manner. The use of standardised forms to control routine activities is an important aid to achieving this objective by ensuring that:

a. Practices and procedures in use are managed in a consistent and easily interpreted format.

b. All relevant aspects are considered.

c. All agencies with a ‘need to know’ are informed.

d. The correct authority is given for the actions to proceed.

Purpose

1.2 This aim of this instruction is to acquaint all members of the Defence organisation involved in EO activities with the system of Defence forms management, and outlines the policy and basic procedures to be adopted for the effective management of forms used in Defence EO activities.

Definitions

1.3 The following definitions apply:

a. **Form.** A form can be any medium with a structured layout for the collecting or recording of information required in carrying out a procedure. The term includes labels used in Defence EO activities.

b. **Form sponsor.** The form sponsor is the authority responsible for the introduction, review and amendment of the form.

c. **Form user.** A form user is any authority that is concerned with the use of a form or the procedure it covers.

d. **Forms provisioner.** A forms provisioner is the supply agency responsible for purchasing, stocking and distributing forms.

Policy

1.4 Defence ePublishing is responsible for managing the standardisation and rationalisation of all forms throughout Defence, maintain a register of Defence forms and providing advice to sponsors and provisioners on the creation and provision of these forms.

1.5 All EO forms are to be registered with Defence ePublishing and be subjected periodically to a process of rationalisation, standardisation and review to avoid duplication and allow economic design standards to be applied.

1.6 Locally produced forms are also to be registered with Defence ePublishing. Although the use of a locally produced form may appear to be limited to one agency initially, a similar requirement may exist in other agencies and the use of the same form is preferred. A suitable existing form should always be used in preference to creating a new form locally.

1.7 Forms used in Defence EO activities are to be described in relevant EO Publications and the reader directed to the appropriate location or organisation (eg Defence Web Forms intranet page, Explosives Ordnance Branch (EOB) etc) where an extant version of the form can be obtained.

Forms managers for explosive ordnance forms

1.8 Suitable appointments within Defence are to be designated EO forms managers and are to be responsible for effective control of Defence EO forms. The forms manager is to be the initial point of contact for all queries and activities such as reviews of, and design changes to forms. The primary roles of forms managers are to coordinate sponsor activities and to advise sponsors on common aspects of form administration, design and production, eg suitable types of materials and adhesives for labels to be exposed to severe weathering versus labels for indoor use.

1.9 All EO forms that are for joint Services use will be managed through the Explosives Storage and Transport Committee section within the Directorate of Ordnance Safety (DOS).

1.10 The management of EO forms for single Service use may need to be addressed similarly by the parent Service.

Form sponsors

1.11 In general, forms should be sponsored by the sponsor of the EO Publication in which the use of the form is prescribed.

Responsibilities of forms managers and sponsors

1.12 The sponsor of EO forms is responsible for their introduction, review, amendment and disposal. When the introduction of a new EO form is proposed, the prospective sponsor is to:

a. Establish the need for a form to standardise a particular function.

b. Determine the information to be included in the form.

c. Determine the most convenient format to display the information, eg printed or electronic.

d. Establish the likely usage rate for the form.

e. Advise the forms manager of the proposed form.

1.13 If the need for a new EO form is agreed, the forms manager is to authorise the sponsor to proceed as follows:

a. Review the current complement of Defence Forms to ascertain whether an existing form can meet the requirement.

b. Ascertain whether other agencies within the Defence EO organisation have a similar requirement.

c. Forward Form AA 139 Form Action Request, ensuring that as much information as possible is provided to the forms manager for review and on-forwarding to Defence ePublishing.

d. Liaise with the Defence ePublishing, through the forms manager, to establish the most economic design for the form, check printers proofs and confirm printing requirements.

e. Propose amendment to the appropriate EO Publication to include the new form, its method of use and compilation instructions if not available elsewhere.

1.14 Sponsors are to initiate amendment to forms, through the forms manager, in the light of comments or requests from users.

1.15 When forms are amended or the method of use varies, sponsors are to propose amendments as necessary to the parent EO Publication.

1.16 Sponsors, through the forms manager, are to ensure that forms that become obsolete or obsolescent are cancelled and removed from circulation.

Externally initiated form reviews

1.17 Defence ePublishing will initiate form reviews, through forms managers, when advised by the provisioner that stocks are approaching the re-ordering level, using Form AA139. Forms managers are then to arrange for sponsors of forms to review the forms in consultation with all known users and initiate amendment or abolition as necessary. These reviews must be completed in a timely fashion to ensure that unnecessary expense is not incurred by the need to order interim quantities of the old form to cover delays in the review process.

Forms used in Defence explosive ordnance activities

1.18 The forms, including labels, used in the management of Defence EO activities are listed in Table 1–1. This list is provisional and will reduce in number as the intended consolidation of single Service forms into joint Service use forms, takes effect.

1.19 The forms listed in Table 1–1 are those that are particular to EO activities, eg Form EO 001 Explosives Limit Licence - Large Quantity Facility, together with forms which have wider general application but are also used in EO activities, eg Form SG 002 Application for Deviation.

Form Number	Name	NSN	Source From	eDEOP 101 Reference
AB 081	Environmental Clearance Certificate		Web Forms	Regulation 5.5 Procedure 1
AB 788	Shipper's Declaration for Dangerous Goods – Surface Mode	7530-66-120-0709	Web Forms	Regulation 3.1 Procedure 1
AE 141	EO Packaging Report		Web Forms	Regulation 2.3 Procedure 2 Annex A
AE 303	Application for Explosive Limit Licence		Web Forms	Regulation 5.2 Procedure 1 Annexes A-E, G
AE 306	Emergency Procedures Guide		Web Forms	Regulation 3.1 Procedure 1
AE 307	Emergency Procedures Guide		Web Forms	Regulation 3.1 Procedure 1
AE 319	Certificate of Clearance for Explosive Ordnance (EO) Area, Facility, Burning Ground or Demolition Ground		Web Forms	Regulation 5.2 Procedure 1
AMSA 250	Multimodal Dangerous Goods Form		AMSA Website	Regulation 3.1 Procedure 1
EO 001[1]	Large Quantity Facility (LQF) Licence		DEOS Website	Regulation 5.2 Procedure 1
EO 002[1]	Small Quantity Facility (SQF) Licence		DEOS Website	Regulation 5.2 Procedure 1
EO 003[1]	Explosives Handling Area (EHA) Licence		DEOS Website	Regulation 5.2 Procedure 1
EO 004[1]	Explosives Disposal Area (EDA) Licence		DEOS Website	Regulation 5.2 Procedure 1
EO 005[1]	Fireworks and Display Area (FDA) Licence		DEOS Website	Regulation 5.2 Procedure 1
EO 006	Area of Operations (AO) Licence		eDEOP 101	Regulation 5.2 Procedure 1
EO 007[1]	Non-Explosive Dangerous Goods (NEDG) Facility Authorisation		DEOS Website	Regulation 5.2 Procedure 1
EO 016	Explosive Ordnance (EO) Incident		Web Forms	Regulation 1.3 Procedure 1
EO 022	Defence Transit Seal	7690-66-149-1062	MILIS	Regulation 2.3 Procedure 5
EO 039	Application to Inspect and Certify or Render Explosive Ordnance Inert		Web Forms	Regulation 2.4
EO 041	Label – Condition Status Serviceable (Large)	7690-66-149-1216	MILIS	Regulation 2.3 Procedure 4 Annex B
EO 042	Label – Condition Status – Serviceable (Small)	7690-66-149-1215	MILIS	Regulation 2.3 Procedure 4 Annex B
EO 043	Label – Condition Status – Repairable (Large)	7690-66-149-1214	MILIS	Regulation 2.3 Procedure 4 Annex B
EO 044	Label – Condition Status – Repairable (Small)	7690-66-149-1254	MILIS	Regulation 2.3 Procedure 4

Form Number	Name	NSN	Source From	eDEOP 101 Reference
EO 045	Label – Condition Status – Not-Repairable (Large)	7690-66-149-1255	MILIS	Regulation 2.3 Procedure 4
EO 046	Label – Condition Status – Not-Repairable (Small)	7690-66-149-1256	MILIS	Regulation 2.3 Procedure 4
EO 047	Label – Warning – Damaged Store (Large)	7698-66-149-1261	MILIS	Regulation 2.3 Procedure 4
EO 048	Label – Warning – Damaged Store (Small)	7690-66-149-1262	MILIS	Regulation 2.3 Procedure 4 Annex B
EO 049	Label – Condition Status – Pending (Large)	7690-66-149-1257	MILIS	Regulation 2.3 Procedure 4 Annex B
EO 050	Label – Condition Status – Pending (Small)	7690-66-149-1258	MILIS	Regulation 2.3 Procedure 4 Annex B
EO 051	Label – Salvage/Return	7690-66-149-1259	MILIS	Regulation 2.3 Procedure 8
EO 052	Label – Certified Empty (FFE)	7690-66-149-1260	MILIS	Regulation 2.3 Procedure 7
EO 077	Authorised Use and Explosives Content of an Explosives Facility		Web Forms	Regulation 4.4 Procedure 13
EO 080	Explosive Ordnance Facility Inspection Record		Web Forms	Regulation 1.4 Procedure 2 Annex A
EO 081	Explosive Ordnance Facility Temperature and Humidity Record		Web Forms	Regulation 1.4 Procedure 4
EO 082	Explosive Ordnance Facility Inspection Record – Hardstand Area		Web Forms	Regulation 1.4 Procedure 4
EO 087	Pyrotechnics and Installed Explosive Ordnance Register	7530-66-116-1568	Web Forms	Regulation 1.5 Procedure 1 Annex B
EO 100	Explosive Ordnance Inspection and Test Report	7530-66-101-0837	Web Forms	Regulation 1.5 Procedure 1
GI 039	Application for UN Classification of Explosives	7530-66-116-4371	Web Forms	Regulation 2.1 Procedure 1
GI 049	Unit Load Placard	7530-66-138-6445	MILIS	Regulation 4.8 Procedure 1
GI 050	Unit Load Contents Record	7530-66-138-6406	MILIS	Regulation 4.8 Procedure 1
GI 051	Explosive Ordnance Stack Record	7530-66-138-6407	MILIS	Regulation 4.8 Procedure 1
GI 107	Label – Packing and Repacking of Explosive Ordnance	7530-66-126-2439	MILIS	Regulation 2.3 Procedure 4
SG 131	Certificate of Safety for Handling, Transport and Storage of Explosive Ordnance	7530-66-116-4378	Web Forms	Regulation 3.1 Procedure 2
ST 160	Shipper’s Declaration for Dangerous Goods (for air mode)	7530-66-117-4443	Web Forms	Regulation 3.1 Procedure 1
TI 009	Inflatable Liferaft Log Card		MILIS	Regulation 1.5 Procedure 1 Annex B
WR 039	In-Service Surveillance Report of Attendance at Range Practice	7530-66-118-6179	Web Forms	Regulation 1.4 Procedure 3

Form Number	Name	NSN	Source From	eDEOP 101 Reference
WR 039	In-Service Surveillance Report of Attendance at Range Practice	7530-66-118-6179	Web Forms	Regulation 1.4 Procedure 3
	Fraction Label - Large	7690-66-010-4370	MILIS	Regulation 2.3 Procedure 4
	Fraction Label - Small	7690-66-010-4371	MILIS	Regulation 2.3 Procedure 4
	Symbols indicating Fire Hazards of Explosives	9905-66-120-6214	MILIS	Regulation 4.7 Procedure 1

Table 1–1: List of Explosive Ordnance related Forms used in Defence

Note:

1. All available on application via Form AE 303.

GLOSSARY OF TERMS

To avoid conflict with general usage, terms in this manual which have particular meanings are listed in the succeeding paragraphs. Further definitions may be found in Australian Defence Glossary (ADG).

A

Above–ground storage

Storage in magazines, with or without earth-cover, or in open stacks at surface level.

Note: An accidental explosion at the storage site results in blast, fire and projections.

Accident

An unintended event or sequence of events that cause death, injury, environmental or material damage.

Active Surveillance

Those surveillance activities which are conducted to monitor critical parameters and are typically tailored for the specific item of explosive ordnance (EO), such activities may include propellant testing or proofing.

Aerosol

A dispersion of particles in a gas, eg smoke.

Air Termination Network

(Lightning Protection) the part of a lightning protection system that is intended to intercept lightning discharges.

Airworthiness Standards Representatives (ASR)

A Commonwealth employee with delegated authority from the Technical Airworthiness Regulator to prescribe and revise airworthiness standards for the ADF.

Aircraft Safety Point (ASP)

An authorised location where aircraft stores delivery systems are changed to a state of readiness or where the fitment of safety devices or the disconnection of energy sources reduces the state of readiness. Additionally, aircraft stores which have malfunctioned or have not been released due to a malfunction of the aircraft stores delivery system may be unloaded at an ASP if this is considered necessary for safety reasons.

Ammunition

Any contrivance charged with explosives, propellants, initiating composition or nuclear, biological or chemical material for use in connection with offence or defence including demolitions.

Notes:

1. Certain ammunition can be used for training, ceremonial or non-operational purposes.

2. Is restricted to conventional ammunition and the conventional explosive components of nuclear ammunition or ammunition containing toxic chemical agents.

3. Includes explosives in made up charges; explosives (chemical fillings and incendiary, smoke

or pyrotechnic material) in bulk; non explosive projectiles of all natures; non explosive stores and components for use in the initiation or assembly of projectiles or explosives charges; and dummy, imitation, instructional and other inert items intended to represent any of the munitions of war referred to above.

Comments

1. The term 'ammunition' in its restricted meaning is used throughout this manual in the same sense as explosive article is used by United Nations (UN) and International Maritime Organisation (IMO), in the Orange Book—*Recommendations on the Transport of Dangerous Goods—Model Regulations*, ST/SG/AC.10/1 and International Maritime Dangerous Goods (IMDG) Code respectively, to mean an article containing one or more explosive substances.

2. The term 'ammunition and explosives' is used as a generic term by European countries (and in the Allied Ammunition Storage and Transport Publication 1 (AASTP-1) :2010 Manual of NATO Safety Principles for the Storage of Military Ammunition and Explosives[1] in the same sense as the term 'explosive ordnance' is used by American and Australian forces.

Ammunition/Explosive Ordnance Lot

A quantity of ammunition by weight, eg propellant, or number, eg fuzes which should possess identical functioning and keeping properties.**Ammunition/Explosive Ordnance Produce**

Ammunition packages, components, links, cartridge cases, etc, resulting from range practices or demolitions.

Ammunition with a Propelling Charge

Is assembled with a propelling charge, or packed with a propelling charge in the same package or palletised with a propelling charge on the same pallet.

Antistatic (Adjective)

Used to indicate that a material is, by virtue of its low resistivity, incapable of retaining a significant static charge when in contact with earth.

Anti-static Floor

A floor designed to be sufficiently electrically conductive to disperse charges of static electricity, but to have sufficient electrical resistance to minimise the danger from electric shock.

Antistatic Footwear

Footwear having a resistance range between 100 x 103 Ohm and 50 x 106 Ohm.

Arming

The process by which explosive ordnance changes from a safe condition to a state of readiness for initiation.

Assembly place

An assembly place is a building or place where it is customary for people to assemble, eg a church, school, sports stadium.

[1] The continued use of AASTP 1: 2010 is under review

Authorised Engineering Organisation (AEO)

An organisation that has been certified (awarded an Engineering Authority Certificate) by the Technical Airworthiness Regulator to provide design or engineering management services to the ADF.

B

Ball Ammunition

Small arms cartridges with a general-purpose solid core bullet.

Barricade

A natural ground feature, artificial mound, traverse or wall which for storage purposes is capable of preventing the direct communications of explosion from one quantity of explosives to another although it may be destroyed in the process.

Barrier Bag

The inner package that protects the contents from the atmospheric or RF environment likely to be encountered in storage.

Note: Provided it meets the requirements of the relevant packaging drawing or other instruction, the bag need not necessarily be completely impervious to air or moisture, as it will have been designed to afford the contents adequate protection for the likely period of storage.

Base

That part of the projectile to the rear of the driving band.

Base Cover

(US term) A device to prevent propellant gases from coming into contact with the filling of HE projectiles through flaws in the metal of the base. It is either welded into position or secured by caulking. It is equivalent to the British base plate.

Basic Load

Is that quantity of non-nuclear explosive ordnance which is authorised and required to be on hand within a unit or formation at all times.

Note: It is expressed in rounds, units or units of weight as appropriate.

Basic Module

Basic Module is applicable to field storage of explosive ordnance and consists of 5000 kg Net Explosives Quantity (NEQ) of EO stored in any storage facility or open stack.

Batching

A method of controlling the assembly of components by lots into complete rounds of fixed or semi fixed ammunition which consists of a number of components, eg. fuze, projectile, propellant and primer.

Batch/Lot

A definite quantity of explosive ordnance or explosive substance manufactured or produced under conditions that are presumed homogenous.

Batten

A wooden lath used when stacking ammunition to achieve stability within a stack and assist ventilation of the contents of the stack.

Blank Ammunition

A cartridge case or cloth bag containing propellant, normally gunpowder, without a projectile.

Note: Its function is to produce a loud noise on firing when used in training, signalling or salutes.

Blast

A destructive wave produced in the surrounding atmosphere by an explosion. The blast includes a shock front, high-pressure gas behind the shock front and a rarefaction following the high pressure.

Blasting Cap

Sometimes synonymously used for detonator.

Blind

A prepared explosive store which, though initiated, has failed to arm as intended or which has failed to explode after being armed (see Misfire). Alternately, an explosives item that fails to function correctly after initiation.

Boattail

The conical section of a ballistic body that progressively decreases in diameter towards the tail to reduce overall aerodynamic drag.

Boiling/Steaming Out

The processes involving the removal of explosives from containers using jets of hot water or steam.

Bomb

An explosive article which is dropped from aircraft. It may contain a flammable liquid with bursting charge, a photo-flash composition or bursting charge. The term excludes aerial torpedos.

Bond

A physical and electrical connection between a metal object and a lightning protection system.

Notes:

1. A bond produces electrical continuity, minimises electro-magnetic potential differences and prevents side-flash.

2. There are mechanical, compression and thermal types of bonds.

Bonding, Electrical

A conductor intended to provide electrical connection between the Lightning Protection System and other metalwork and between various metal parts of a structure or between earthing systems.

Booster

The process of connecting two or more conducting objects together by means of a conductor.

Breakdown

The mechanical process of dismantling or disassembling explosive ordnance according to a pre-determined plan.

Bulk Explosives

Service charges of explosives which are generally removed from their containers before use, such as Charges Demolition PE4.

Bunker-Type Building

A bunker-type building is one intended to hold explosive ordnance and having protection in the form of a substantial covering of earth.

Note: Sometimes the building is partly sunk below ground level for extra protection.

Buried storage

Buried storage is storage in chambers or magazines below ground surface level. In the case of an accidental explosion at the storage site, the hazard of low-angle, high velocity projections is reduced significantly. The other hazardous effects are similar to those in above-ground storage, but are gradually reduced as the cover is increased.

Burning

The energetic material ignites and responds, non-propulsively.

Notes:

1. The case may open, melt or weaken sufficiently to rupture non-violently, allowing mild release of combustion gases.

2. Debris stays mainly within the area of the fire.

3. This debris is not expected to cause fatal wounds to personnel or be a hazardous fragment (having an impact energy of 79 joules or greater) beyond 15 m.

Burning ground

A burning ground is an enclosed area within a Defence facility used for the disposal of explosive ordnance by fire.

Note: Fires may be in the open, in burning pits or in specially constructed incinerators.

C

Cable – Armoured

Electrical cable provided with an overall metallic sheath of steel wire or steel tape, usually polyvinyl chloride (PVC) served, providing mechanical protection to the cable cores.

Note: Screening overall or of individual cores or pairs as in communication cables to mitigate noise is not to be confused with armouring.

Calibration

A process of comparing equipment of unknown accuracy against standard equipment of known accuracy.

Calibre (CAL)

The diameter of a smooth bored weapon or distance between opposing lands of a barrel.

Cannon

The name given to all weapons firing artillery ammunition.

Note: Covers guns and howitzers.

Cartridge

Ammunition, ready for firing, wherein the propelling charge(s), its primer, with or without the projectile with its fuze are assembled in one unit for handling and firing.

Note: Examples of cartridge ammunition are gun, cannon, howitzer, Mortar, small calibre ammunition, blank cartridges for training, saluting or starter pistols.

Cartridge Case

The metal container that holds the propellant and primer of a fixed, semi fixed or separate cartridge, normally made of brass or steel.

Centre of Expertise (CoE)

An AEO in which the Senior Design Engineer position is a designated Airworthiness Standards Representative (ASR) appointment.

Certification

The end result of a process which formally examines and documents compliance of a product, against predefined standards, to the satisfaction of the certificating authority.

Certified inert

An item of inert explosive ordnance that has been certified as inert EO by a competent and authorised person**.**

Charge

The explosive filling of a munition or a munition component.

Classification

See Hazard Classification.

The assignment of a type of ammunition to the correct hazard division, according to tests or other assessment, and the appropriate compatibility group.

Notes:

1. Thus there are two components in the complete hazard classification.

2. Frequently, classification is used as a short form of hazard classification.

Clean Area

That portion of an Explosives Building from which it is essential to exclude extraneous grit or dust, ie inside the barrier of the shifting lobby.

Clean Conditions

The conditions necessary to minimise the special risks associated with the storage and maintenance (including inspection) of certain natures of explosives.

Compartment

A room within an explosive ordnance building with walls of sufficient strength to prevent the direct propagation of the explosion or ignition of the contents of the room to those of the adjacent rooms.

Compartmented Building

A building with separate rooms, without connecting doors, in which the dividing walls are constructed of brick or concrete blocks not less than 230 mm thick.

Note: Walls less than 230 mm thick are not to be considered as efficient partitions.

Compatibility

1. **General**: Capability of two or more items or components of equipment or material to exist or function in the same system or environment without mutual interference (AAP-6).

2. **Munitions**: Absence of reactions between explosives and other components within a munition, leading to unacceptable changes in physical properties, sensitiveness or sensitivity of explosives in the munition.

3. **Classification**: Capability of explosives, including ammunition, to be stored or transported together without significantly increasing either the probability of an accident or, for a given quantity, the magnitude of the effects of such an accident.

Compatibility (groups)

Letter designation assigned to indicate what may be shipped and transported without significantly increasing either the probability of an accident or, for a given quantity, the magnitude of the effects of such an accident.

Competent Authority

A person being either a Senior Executive Officer within the meaning of the *Public Service Act 1999* or a Commissioned Officer of the Australian Defence Force being an officer of at least the rank of Commodore, Brigadier or Air Commodore, and appointed in writing to be a Competent Authority by the Minister for Defence for matters pertaining to the administration of the *Explosives Act 1961* and the Regulations made under this Act.

Competent Person

A person, who has acquired, through training, qualification and experience, the knowledge and skills enabling that person to perform the required task correctly.

Notes:

1. The competency of the person shall be relevant to the type of work to be undertaken.

2. For Explosives Hazardous Areas the person shall also have as a prerequisite, training and experience for conventional hazardous areas (as defined in AS/NZS 3000:2018 : Electrical installations (known as the Australian/New Zealand Wiring Rules).

Comprehensive Classification List

A list dealing with the classification of Commonwealth explosive ordnance for storage and transportation purposes and described in the *Explosives Transport Regulations 2002* Schedule 1

Note: A complete list of Defence explosive ordnance is contained in Explosives Storage and Transport Committee (ESTC) Pamphlet No 2 – Defence Explosive Ordnance Classification Listing (DEOCL).

Commercial Explosives

Any explosive designed or produced for non-military use.

Commonwealth Explosives or Explosive Ordnance

Commonwealth explosives means explosives that:

a. Are the property of, or are in the possession or control of the Commonwealth; or

b. Have been manufactured by the Commonwealth and, in pursuance of an arrangement made with the Commonwealth, are intended to be, or are being exported from the Commonwealth; or

c. Are the property of, or are in possession of, or are in possession and control of, the government or the naval, military or air forces of another country and are in the Commonwealth or a Territory with the approval of the Commonwealth for the purposes of, or a purpose related to, the defence of the Commonwealth.

Component

A component is part of guided weapons equipment, when referring to ground handling equipment or guidance station equipment, or is part of a section of a missile or sub-assembly of other ammunition, eg fuze or primer.

Conducting Floor

Flooring having a resistance range of zero to 50 x 10^3 Ohm.

Conducting Shoes

Footwear having a resistance range of zero to 150 x 10^3 Ohm.

Cone of Protection

The space coverage provided by a vertical conductor.

Note: It is an element within a lightning protection system.

Configuration

The functional and physical characteristics of existing or planned hardware, firmware, software or a combination thereof, as set forth in technical documentation, including specifications, standards and drawings, and ultimately achieved in a product.

Consequence

The outcome of an event expressed qualitatively or quantitatively, being a loss, injury, disadvantage or gain. There may be a range of possible outcomes associated with an event.

Constraint

The imposition of a limitation or restriction in the use, transportation, carriage, issue, storage or inspection of a munition.

Contingency

Any situation that involves force elements committed to higher rates of effort than experienced in normal peacetime operations.

Corporate Governance

Corporate Governance is an integrated strategic management framework designed to support corporate objectives. It is about maximising the value of an organisation, subject to meeting the organisation’s financial and other legal and contractual obligations.

Curtain Wall Construction

A building with one of four storeys or more that is constructed with external non-load bearing cladding panels on a separate subframe which is supported off the structural frame or floors for the full height of the building.

Note: Where these cladding panels are large (greater than 1 500mm) and constructed of glass or similar lightweight frangible material, which is liable to shatter producing dangerous fragments or be displaced under the effect of lateral explosive blast loads greater than the designed wind forces, the curtain walling would be considered a hazard to personnel both inside and outside the building because of flying fragments or falling panels.

D

Danger Area

The area within which debris and fragments of explosive ordnance may be expected to fall after the detonation of explosives. Also see Explosives Area.

Dangerous Goods

Articles or substances which are capable of posing a risk to health, safety, or property, and which are subject to special regulations for their storage and transport.

Dangerous Occurrence

An unplanned, unintended, unexpected and/or undesired event, or series of events, which could have resulted in death, injury, occupational illness, substantial damage to the environment or damage to equipment or property, regardless of ownership.

Notes:

1. This includes Negligent Discharges (ND) and Unauthorised Discharges (UD).

2. Air Force Examples include:

    a. A missile falls from an aircraft in flight and is subsequently found to have fallen harmlessly into open ground, or is never found with no report or no untoward reports of the incident from the public.

    b. An aircraft gun is accidently fired during electrical installation checks at the aircraft flightline, but no injuries or damage are sustained.

    c. Accidental striking of Unexploded Ordnance (UXO) by earth moving or heavy plant equipment.

Debris

Debris is any portion of the natural ground or of a structure (rocks, structural materials, fittings, equipment, barricade materials, etc.) which is propelled from the site of an explosion.

Defect

A fault, other than by fair wear and tear, which renders an item unsuitable for its intended use. The fault may be in design or deviation of a dimension, finish or other functional characteristic from specified requirements or from recognised standards of engineering practice.

Defence Storage and Transport (S&T) Network

The Defence S&T Network is described as any EO which is stored within Defence-owned or leased EO facilities (including ADF EO, foreign defence force EO or contract EO) or transported by Defence or Defence contracted organisations where there is a duty of care upon Defence.

Deflagration

Chemical explosion in which the zone of chemical reaction propagates through the initial medium at a subsonic velocity, mainly by thermal conduction.

Demilitarisation

The act of removing or otherwise nullifying the military potential of a munition. Demilitarisation is a necessary step for military items prior to their release to a non-military setting.

Demolition ground

An enclosed or otherwise well delineated area within a Defence facility used for the disposal of explosive ordnance by explosive demolition.

Note: Demolitions may be on an open surface, behind screening traverses or in pits, be buried or be conducted in specifically constructed facilities designed to contain or suppress the effects of explosion.

Design

The process or act of creating or changing a product and related technical process descriptions through the application of scientific and engineering effort, or the outcome of that process.

Note: the design encompasses not only the configuration of the product, but also the:

a. testing and evaluation needed to validate that the design meets performance and safety requirements;

b. manufacturing processes (including production test requirements) which require special control to ensure the product meets requirements;

c. in-service monitoring requirements, maintenance processes and authorised repairs;

d. maintenance lives and intervals and fatigue life; and

e. operating procedures and limits.

Design Acceptance Certification

The final act of the Design Acceptance process whereby a Design Acceptance Representative (DAR) provides a certified record of the technical acceptability of a change to specified Defence materiel. The most equivalent act, within the Maritime Technical Regulatory Framework (TRF), is the issue of a Design Certificate following validation of the design by the Design Acceptance Representative.

Design Acceptance Representative (DAR)

A Commonwealth employee with delegated authority from the Technical Airworthiness Representative (TAR) to perform Design Acceptance Certification of changes to Defence materiel. Known as Design Acceptance Authority Representatives (DAAR) within the Land TRF.

Design Approval Certification

The act of approval of design output resulting from a process that formally examines and documents compliance of a design (or design change) with specified requirements and design standards. Within the Maritime TRF, the most equivalent act is the issue of a Designer's Certificate certifying that a design meets specified design requirements and is fit for service, safe and environmentally compliant.

Design Certification Basis

The suite of standards against which materiel is to be design certified, derived from or judged to be equivalent to a subset of the materiel standards approved by a TRA.

Design Change

A change to the approved configuration documentation of an item, or a proposed deviation from the approved design configuration. Known as Engineering Change within the Maritime and Land TRF.

Design Review

The act whereby a design (or design change) is independently checked by an authorised, competent person (other than the person who developed the design) to: verify the validity of the assumptions, conditions, data and methods used in design development; and to verify that the design output satisfies technical integrity requirements.

Design Support Network

A collective term used to describe a group of agencies that provide design support to an AEO. Known as a Technical Support Network within the Land Technical Regulatory Framework.

De-stuffing

The process of removing cargo and cargo bracing materials (dunnage) or other methods of restraints, from a container.

Detonation

Decomposition reaction in which the zone of chemical reaction propagates through the initial medium at a supersonic velocity behind a shock front.

Detonator (DET)

A component containing at least one high explosive which, upon receipt of a specified stimulus (mechanical, electrical, pyrotechnic or other), will produce an output (shock wave and/or fragments) which is used to initiate a high explosive charge or another component of an explosive train. It may be constructed to detonate instantaneously, or may contain a delay element.

Deviation

An official deviation process must be followed to document and approve an increased level of risk before conducting an activity which does not comply with the requirements of the eDEOP 101 and superordinate publications. See Regulation 1.2 - Deviations from Mandatory Explosives Safety Requirements

Dirty Area

The part of a magazine or laboratory outside the safety barrier.

Disposal

The end-of-life tasks and actions for residual materials resulting from demilitarisation operations.

Notes:

1. Disposal encompasses the process of redistributing, transferring, donating, selling, or destroying military EO.

2. The Explosive Ordnance Disposal (EOD) activities are not included in this definition.

Down Conductor

A conductor that connects an air terminal network with an earth termination.

Dunnage

A length or lengths of timber or concrete used during storage to raise explosive ordnance from the floor surface to permit ventilation of the bottom layer of the stack of containers or projectiles.

Dust-Proof

Electrical components that are required to be constructed or protected so that dust will not interfere with their efficient operation.

Dust-Tight

Electrical components that are required to be constructed so that dust will not enter their enclosing case.

Dusts of Explosives

Dusts that are inherently explosive, as they have their own oxidant and are hazardous whether airborne or not.

E

Earthing

The process of making a satisfactory electrical connection between the structure, including the metal skin, of an object or vehicle, and the mass of the earth, to ensure a common potential with the earth.

Earth Electrode

That part of the earth termination network in a lightning protection system which makes direct electrical contact with the general mass of earth.

Earth Termination Network

That part of the lightning protection system that is intended to discharge lightning currents into the general mass of the earth. All parts below the lowest test joint in a down conductor are included.

Ejecta

Any portion of the natural ground which is projected from the site of an explosion.

Electro-Explosive Hazard (EEH)

Any explosive hazard that is caused by the inadvertent functioning of an electrically initiated device due to the uncommanded transfer of electrical energy to that device.

Electro-Explosive Device (EED)

An explosive or pyrotechnic component that initiates an explosive, burning, electrical, or mechanical train and which is activated by the application of electrical energy.

Electro-Explosive Devices (EED) Preparation Room

A room in a building authorised for the storage, maintenance, assembly, testing and preparation for issue of electro-explosive devices, eg explosive bolts, cable cutters, and demolition detonators (electrical).

Electrostatic Earthing

A specific form of bonding by means of which one or more conducting objects are connected to earth by a conductor.

Energetic Material

A substance or mixture of substances that, through chemical reaction, is capable of rapidly releasing energy.

Energetic Material Qualification (EMQ)

The assessment of explosive material by a relevant national authority to determine whether it possess properties which make it safe and suitable for consideration for use in a particular role (eg as a main charge filling, a booster, propellant, gun propellant or illuminant pyrotechnic).

Engineering Authority (EA)

The authority assigned expressly to an organisation Authorised Engineering Organisation (AEO) or to an individual within an organisation to undertake specific engineering activities.

Environmental Compliance

Following Departmental environment instructions to minimise risks and maintain accountability in relation to environmental protection matters.

Equipotential Bonding

Electrical connections intended to bring exposed conducting parts or extraneous conducting parts to the same or approximately the same potential but not intended to carry current in normal service.

Errors in Drill

Any incident or hazardous practice concerning the use of ammunition resulting from some deficiency in regulations, drill or instructions.

Essential Building or Facility

A building or facility whose destruction or severe damage would impair the operational efficiency of the establishment.

Event

Certain or uncertain occurrence of a particular set of circumstances.

Notes:

1. The event can be a single occurrence or a series of occurrences.

2. The probability associated with the event can be estimated for a given period of time.

Event Tree Analysis

Tree procedure related to a given failure (recognised), used to analyse the consequences of this failure on the system, to determine whether the final states obtained contained one or more feared potential events.

Experimental Explosive Ordnance

Any explosive ordnance which, as issued for trial or experiment, is known to contain any component or material differing from the approved service design, or in which the method of filling design departs from the approved service design.

Explosion

A nuclear, chemical or physical process leading to a sudden release of energy.

Explosive

A substance manufactured with a view to producing an explosion or pyrotechnic effect.

Note: An explosive atmosphere of gas, vapour or dust is not considered to be an explosive.

Comments: The term 'explosive' is used throughout this manual in the same sense as 'explosive substance' is used by the United Nations and International Maritime Organisation, in the Orange Book—*Recommendations on the Transport of Dangerous Goods—Model Regulations*, ST/SG/AC.10/1 and International Maritime Dangerous Goods Code respectively, to mean in its broadest sense all explosive and pyrotechnic substances. The term may be made more restrictive by qualifying it with such terms as primary or secondary. Also, for the purposes of this manual, the term 'explosive' may also include ammunition.

Explosives Hazardous Area

An area in which an explosive substance is or may be exposed to the atmosphere.

Explosives Hazardous Area Zones

Zones based upon the frequency of the occurrence and duration of the explosives dust or explosives vapour being exposed.

Explosives Hazardous Area Zones – Adjacent Zones

An area where explosives hazardous area zones and/or hazardous area zones are located adjacent to each other.

Explosives Hazardous Area Zones – Coincident Zones

Where different explosive hazardous area (EHA) and/or hazardous area (HA) zones exist in the same space.

Explosive Hazard Data Sheets

A document providing information on hazard data and safety test results for energetic material.

Notes:

1. They contain the results of specific sensitiveness and stability tests of energetic material in loose powder form.

2. Depending on the country of origin, they are also known as Explosive Safety Certificates and Hazardous Components Safety Data Statements.

3. These are not chemical Safety Data Sheets.

Explosives Limit

The permitted net explosives quantity for explosive ordnance in a building or site.

Explosive Ordnance (EO)

All munitions containing explosives, nuclear fission or fusion materials and biological and chemical agents.

Notes:

1. This includes bombs and warheads; guided and ballistic missiles; artillery, mortar, rocket and small arms ammunition; all mines, torpedoes and depth charges, demolition charges; pyrotechnics; clusters and dispensers; cartridge and propellant actuated devices; electro-explosive devices; clandestine and improvised explosive devices; and all similar or related items or components explosive in nature.

2. Used as a generic term in the same sense as the term 'ammunition and explosives' is used in the equivalent Allied Ammunition Storage and Transport Publication 1 (AASTP-1): 2010 Manual of NATO Safety Principles for the Storage of Military Ammunition and Explosives[2].

Explosive Ordnance Area / Explosives Area

An explosives ordnance area or Explosives Area is an area used for the handling, processing and storing of explosive ordnance. Where there is no fence, it is taken as being the area within a radius of 50 m from any building or stack containing explosive ordnance.

Explosive Ordnance Apron

An area on an airfield, authorised by a competent authority, designated for the loading, unloading and parking of aircraft engaged in the transportation of explosive ordnance as air cargo.

Explosive Ordnance Certification

Certification which declares that an explosive ordnance (EO) capability, as directed by the capability sponsor, is supportable.

Notes:

1. EO certification may be declared by the EO management organisation executive authority (or representative) when an EO design certification is combined with an EO logistical certification.

2. The EO certificate (EOC) documents of the attainment of EO certification.

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[2] The continued use of AASTP 1: 2010 is under review

Explosive Ordnance Certification Plan (EOCP)

Details explosive ordnance (EO) certification requirements ie design certification basis, organisational responsibilities for the development of assessments and the conduct of engineering activities such as integration, and test and evaluation.

Notes:

1. The plan includes schedules and activities that mitigate risk ensuring necessary engineering and logistics activities are completed when required, and prior to service release.

2. The EOCP satisfies the requirement for a certification plan, Navy Technical Regulations Manual (NTRM), technical certification plan, Technical Regulation of Army Materiel Manual (TRAMM), design plan and the Technical Airworthiness Management Manual (TAMM).

Explosive Ordnance Depot

An establishment at which large stocks of explosive ordnance are stored and maintained.

Note: Normally it contains an explosives area, ammunition process buildings, an established proof yard, a demolition ground, transport facilities, attendant offices and other facilities required for the storage, inspection, maintenance and movement of explosive ordnance.

Explosive Ordnance Design Assessment (EODA)

The EODA details the technical integrity assessment of EO within a defined environment. The EODA satisfies the requirement for a System Safety Assessment, Safety and Suitability for Service (S3) Assessment and a Safety Case Report (SCR).

Explosive Ordnance Disposal (EOD)

The detection, identification, on-site evaluation, rendering safe, recovery and final disposal of unexploded explosive ordnance. It may also include explosive ordnance which has become hazardous by damage or deterioration.

Explosive Ordnance Disposal (EOD) Procedures

Any particular course or mode of action taken by qualified (EOD) personnel to render safe, disassemble, neutralise or dispose of EO, improvised explosive device (IED) or any hazardous material associated with an EO incident.

Note: Procedures include:

a. Render Safe Procedure. That portion of the EOD procedures which provide for the interruption of functions or separation of essential component of EO to prevent a detonation or function

b. Disposal Procedures. That portion of EOD procedures pertaining to the final disposition of EO by EOD personnel. Disposition may be effected by demolition, burning, dumping at sea, breakdown, transfer of disarmed items or residue to the Service having logistic responsibility or by placing such items or residue in proper channels for further evaluation

Explosive Ordnance Facility

The generic designation for any building, site or area at which explosive ordnance is or is intended to be stored, packaged or unpackaged, prepared, inspected, maintained, loaded or unloaded to aircraft or vehicles of all types, eg all danger buildings such as explosives storehouses, igloos, laboratories, ready-use compartments, explosive ordnance preparation areas (EOPA) or buildings, ordnance loading aprons (OLA), explosive ordnance preload area (EOPLA), air movements explosive ordnance apron (AMEOA), aircraft safety point (ASP) and aircraft hardened shelters.

Note: This term is used interchangeably with the term’s danger building and danger facility.

Explosive Ordnance Incident

An explosive ordnance related incident is an unplanned or unexpected event or series of events involving explosive ordnance and which results or could have resulted in death, injury, occupational illness, or damage to or loss of equipment or property, or damage to the environment.

Explosive Ordnance Management Organisation

Organisations which are responsible for explosive ordnance (EO) item management, ie EO acquisition organisations and in-service EO management organisations.

Explosive Ordnance Package

A re-usable item of rigid construction and of any configuration so designed as to enclose and provide protection for ammunition against impact, vibration, climatic conditions and the like, during handling, shipment and storage.

Note: It may embody integral fastenings shock absorbing media, compartments and attachments for handling; and in addition, be capable of being pressurised or hermetically sealed.

Explosive Ordnance Preload Area (EOPLA)

An area or building, authorised by a competent authority, in which prepared explosive ordnance is loaded to aircraft stores suspension equipment prior to loading to an aircraft.

Notes:

1. Such preloaded equipment may be held in the area in ready-for-use condition.

2. The area is normally combined with, or adjacent to, the explosive ordnance preparation area.

Explosive Ordnance Preparation Area (EOPA)

An area, facility or building authorised by a competent authority, in which aircraft associated explosive ordnance may be unpacked and repacked, prepared for use, loaded to ground support equipment for transportation to the explosive ordnance loading aprons or held ready for immediate use.

Notes:

1. Included in this definition are those areas where EO is palletised in preparation or held ready for loading to Aircraft as cargo.

2. Preparation areas are dedicated to the handling of particular items of explosive ordnance, are given specific titles, eg ammunition, bomb, missile or pallet preparation areas.

3. In this context

    a. ‘Ammunition’ refers to aircraft gun ammunition

    b. ‘Bomb’ refers to guided and unguided HE bombs, unguided rocket ammunition (HE or practice, practice bombs (all types) and cluster bomb units);

    c. ‘Missile’ refers to guided missiles only (see also Ammunition Process Building);

    d. ‘Pallet’ refers to aircraft cargo pallets containing EO which is in approved packaging

Explosive Ordnance Ready-Use Shelter (EORS)

A facility, normally of Type 3 or 4 construction situated within, or in the immediate vicinity of, an ordnance loading apron (OLA) complex, where prepared and/or preloaded explosive ordnance is held ready for use.

Explosive Ordnance Safety Assurance Board (EOSAB)

As part of the explosive ordnance (EO) safety system the EOSAB, on behalf of VCDF, provides assurances of the EO safety management within Defence.

Note: Director General Explosive Ordnance (DGEO), as Chair of the EOSAB, provides such assurances through a cyclical program comprising holistic review of the EO Safety Management System (EOSMS) and targeted reviews of the EOSMS elements; and occasional product-based review of the safety management of EO.

Explosive Ordnance Service Release

The process of permitting the actual in-service use of the design change.

Explosive Ordnance Stakeholder Working Group (EOSWG)

The group's primary role is to provide key stakeholder input into the process for the certification of explosive ordnance (EO).

Note; The EOSWG may also be utilised to meet the intent of a configuration control board (CCB) and System Safety Working Group (SSWG).

Explosive Ordnance workshop

Any structure used for the inspection, maintenance and renovation of explosives.

Explosive ordnance storehouse (EOSH)—*see also* magazine

A building designed and erected for the sole purpose of storing explosives or a building modified, adopted or appropriated for that purpose and approved by a competent authority. Explosives storehouses are described according to their method of construction and use:

a. Above ground: A building at natural ground level, the roof and at least one side of which are exposed to the open air.

b. Bunker: A building at natural ground level, the roof and sides of which are covered by earth, access being provided in one side.

c. Igloo: A storehouse normally built at ground level, earth covered and constructed in corrugated steel or reinforced concrete, provided with a strong headwall and door(s). Earth covers the roof, the sides and the rear. The storehouse and its earth cover are designed to stringent criteria for resistance to external blast loading and attack by high velocity projections. The cross-section of the igloo may be semicircular, elliptical, rectangular etc.

d. Underground: A natural or excavated space underground with a ceiling not less than 600mm below the natural ground level, specially adapted for the storage of explosives. Access is by tunnel or lift-shaft.

e. Semi-underground: A building constructed into a hillside with the front face exposed to the open air.

Explosive Material

A substance (or a mixture of substances), which is capable by chemical reaction of producing gas at such a temperature and pressure as to cause damage to the surroundings. The term explosive material includes solid and liquid high explosives, propellants and pyrotechnics (even when they do not evolve gases. The term ‘explosive’ is often used in short for explosive material.

Explosives Safety

Explosives safety is the process used to prevent premature, unintentional, or unauthorised initiation of explosives and devices containing explosives; and with minimising the effects of explosions, combustion, toxicity, and any other deleterious effects.

Notes:

1. Explosives safety includes all mechanical, chemical, biological, electrical and environmental hazards associated with explosives; hazards of electromagnetic radiation to ordnance; and combinations of the foregoing.

2. Equipment, systems, or procedures and processes whose malfunction would hazard the safe manufacturing, handling, maintenance, storage, transfer, release, testing, delivery, firing or disposal of explosives are also included.

Explosives Train

An arrangement used to lead explosive reactions from one place to another.

Note: A sequential arrangement of initiator, intermediary and main charge, eg detonator, booster and main high explosive charge.

Exposed site (ES)

Any location, facility or vehicle which is exposed to the possible effects of an explosion (or fire) at the potential explosion site under consideration, and which requires a level of protection from the effects of that explosion.

Note: Examples are a magazine, cell, stack, truck or trailer loaded with explosive ordnance, explosive ordnance workshop, inhabited building, assembly place or public traffic route.

Exudation

The process through which an energetic material oozes out through opening such as screw threads, fuze cavity, etc.

F

Filling

The explosive content of a cartridge, projectile, bomb, round, component or separate part of a round.

Note: Also applies when the content is not strictly explosive in character, eg smoke or chemical.

Firing

The action to set off an explosive event.

Firing Circuits

1. **Electric/electronic fuzing systems**: The complete (sub) system including the electro-explosive device (EED), power supplies and all associated electrical and electronic components and circuitry necessary for normal EED firing.

2. **Demolition material**: The electrical and explosive circuit connecting the firing control system and the demolition charges to permit their initiation.

Firing Device

A device used to initiate mines, booby traps, demolition charges and anti lift devices.

Firing Point

The point from which the firer initiates the demolition; normally this will be from within the splinter proof shelter.

Fitness for Service

Materiel's ability to satisfy operational requirements. Hence it is a subset of technical integrity.

Fixed Ammunition

Ammunition with the primer and propelling charge contained in a cartridge case which is crimped or otherwise attached to the projectile, the whole being loaded into a weapon as a single unit.

Flame Arrester

A device built in to equipment in order to prevent the unrestricted propagation of flame from within the enclosure to the external surrounding atmosphere.

Flame Trap

See flame arrester.

Flare

A pyrotechnic designed to produce a source of light.

Notes:

1. It is designed primarily for illuminating or signalling and may be fired from weapons, dropped from aircraft, thrown by hand or displayed on the ground.

2. They are manufactured in various colours.

Flash

Flash is:

a. Light radiated at the muzzle of the gun and produced by glowing hot propellant gases, or the ignition of combustible gaseous products of the burnt propellant after shot ejection.

b. Light produced at detonation of the high explosive filling in high explosive (HE) filled stores, eg projectiles, rockets, grenades, mines, etc; or

c. Intense light produced by the extremely rapid burning of a magnesium based pyrotechnic composition used to produce illumination for photographic work by night and usually from aircraft.

Flash Point

The lowest temperature at which a substance gives off sufficient inflammable vapour to produce a momentary flash when a spark or small flame is applied.

Fraction Packaging

Fraction Container Pack. An ammunition package containing less than the quantity of ammunition which it is designed to hold that has been packed and sealed by a competent ammunition person so that it is acceptable for storage and movement in all circumstances.

Fragment/Fragmentation

Any portion of the explosive ordnance or its package which is propelled from the site of an explosion.

Fragment Distance

Based on the number of 'hazardous fragments' which fall into a given area.

Notes:

1. A fragment is 'hazardous' when it has the impact energy to inflict a fatal wound.

2. The range at which the hazardous fragment density is not more than one per 56 m^2 (600 ft^2) area is the fragment distance for that explosive ordnance.

Frequency

A measure of likelihood expressed as the number of occurrences of an event in a given time.

Fuse

A device for protecting a circuit against damage from an excess current by the melting of a fuse element to break the circuit.

Fuze

A device designed to control the initiation of a main charge.

G

Green Line/Zone

The envelope of the lines drawn at the public traffic route (PTR) for each potential explosion site in a facility.

Note: The Green Zone is the area within this line.

H

Hard-Standing

A prepared base, usually of concrete, on which explosive ordnance is stacked.

Hardened Aircraft Shelter (HAS)

Aircraft shelter designed to resist weapons effects.

Hazard

A condition that is a prerequisite to a mishap. Any phenomenon - environmental force or intrinsic effect - having the potential to induce an adverse effect in the munition compromising its safety or suitability for service.

Note: A hazard is characterised by its nature, severity or probability of occurrence.

Hazard classification

The assignment of a type of ammunition to the correct hazard division (HD), according to tests or other assessment, and the appropriate compatibility group. Thus there are two components in the complete classification. Frequently, classification is used as short form of hazard classification.

Hazard classification code (HCC)

An alphanumeric symbol which denotes the complete HCC for a particular nature. The code comprises two or three digits, indicating the HD, followed by a letter corresponding to the compatibility group e.g. 1.3G.

Hazard division (HD)

In accord with the UN Orange Book—*Recommendations on the Transport of Dangerous Goods—Model Regulations*, ST/SG/AC.10/1, explosives, including explosive ordnance, that are deemed not too dangerous to be accepted for transport, are categorised as Dangerous Goods Class 1.

Note: This class is divided into six divisions, commonly known as hazard divisions and are:

a. (Hazard) Division 1.1—substances and articles which have a mass explosion hazard;

b. (Hazard) Division 1.2—substances and articles which have a projection hazard but not a mass explosion hazard;

c. (Hazard) Division 1.3—substances and articles which have a fire hazard and either a minor blast hazard or a minor projection hazard or both, but not a mass explosion hazard;

d. (Hazard) Division 1.4—substances and articles which present no significant hazard

e. (Hazard) Division 1.5—very insensitive substances which have a mass explosion hazard; and

f. (Hazard) Division 1.6—extremely insensitive articles which do not have a mass explosion hazard.

Hazard Identification

The process, by which the existence, in an activity, of an event that might take place whose consequences is undesirable, is recognised.

Hazardous Area

Associated with flammable vapour-air mixtures and combustible dust-air mixtures of normal flammable materials and are divided by the Australian Standards into hazardous area 0, 1, 2, 20, 21 and 22.

Hazardous Fragment

Is one having an impact energy of 79 Joules (58ft-lb) or greater.

Hazardous Fragment Density

The density of hazardous fragments exceeding one per 56 m^2 (600 ft^2).

Hazard Log

The continually updated record of hazard, accident sequences and accidents associated with a system. It includes information documenting risk management for each hazard and accident.

Heavy-walled building

A heavy-walled building is a building of non-combustible construction, used for explosive ordnance storage, with walls of a minimum thickness of 450 mm of reinforced concrete, or 680 mm of brick or equivalent penetration resistance of other materials, with or without a protective roof of greater than 150 mm reinforced concrete with suitable support.

High Capacity Store

An explosive store having a charge/weight ratio of 60% or higher.

High Explosive (HE)

Any explosive substance capable of being detonated.

High velocity projections

Debris or fragments at high velocity as the result of a detonation/explosion and that may have sufficient remaining energy to propagate a detonation/explosion to another stack.

Holding yard

A designated area within a military installation where trucks or rail wagons loaded with explosive ordnance are held for short periods prior to storage or shipment.

Hypergolic Liquid

May ignite spontaneously on exposure to the atmosphere or other oxidant when used as a rocket propellant.

I

Igloo

A magazine, normally built at ground level, with earth-covered roof, sides and rear, and constructed in corrugated steel or reinforced concrete, provided with a strong headwall and door(s).

Note: The magazine and its earth-cover are designed to stringent criteria for resistance to external blast loading and attack by high velocity projections. The cross section of the igloo may be semi-circular, elliptical, rectangular or a combination of these.

Ignition

The commencement of combustion, deflagration or explosion, not detonation.

Notes:

1. Means of ignition may include: propellant, primers, igniters, squibs, fuse igniters.

2. Ignition is normally achieved by an igniter. Detonation is started by initiation.

Improvised Explosive Device (IED)

A device placed or fabricated in an improvised manner incorporating explosive material, destructive, lethal, noxious, incendiary, pyrotechnic or chemicals designed to destroy, disfigure, distract or harass. They may incorporate military stores, but are normally devised from non-military components.

Incident

Is any unplanned, unintended, unexpected or undesired event, or series of events, involving explosive ordnance (EO) that is in the possession or under the control of Defence or is used in a Defence activity, which results, or could have resulted, in death, injury, occupational illness, or damage to equipment or property, or damage to the environment, or facilitates exposure to hazardous substances contained in EO-related items eg asbestos contained in EO components.

Note; Any occurrence that is considered an accident, dangerous occurrence, defect, malfunction, unauthorised discharge (UD), negligent discharge (ND) or involves unsatisfactory materiel is to be reported as an EO incident.

Incorporation

Incorporation is the act of implementing a design change.

Incorporation Approval

Incorporation Approval is the formal process of permitting a design change to proceed from the design to the incorporation phase, committing whatever resources are required for implementation. Incorporation Approval is granted by the Senior Executive or a nominated representative.

Individual Risk

The risk to an individual rather than to a population.

Inert explosive ordnance

An item that resembles EO but does not contain explosive, pyrotechnic or other type or energetic or other hazardous material. The concept of low and high safety risk inert EO have been removed

Inhabited building

A building or structure, other than an operating building, occupied in whole or in part by people.

Initiation

Initiation is the transmission of a violent chemical reaction at supersonic velocity from one explosive into an adjacent explosive so as to cause its detonation. Means of initiation may include: fuzes, primers, detonators, blasting caps.

Inner Package

A substantial case, bag, canister or other receptacle, so constructed and closed so as to prevent any explosive from escaping under normally expected Service conditions of storage and transportation for the contents.

Inter-module Quantity Distance

Applicable to field storage and prevent sympathetic reactions of adjacent basic or storage modules.

Insensitive Munitions (IM)

Insensitive Munitions are defined as those munitions which reliably fulfil their performance, readiness and operational requirements on demand, but which minimise the probability of inadvertent initiation and severity of subsequent collateral damage to weapon platforms, logistic systems and personnel when subjected to selected accidental and combat threats.

In-service Surveillance (ISS)

The process and associated activities, with defined technical integrity indicators, which can be monitored to ensure the explosive ordnance (EO) remains safe and fit for service throughout its defined life.

Inside quantity distance (IQD)

The minimum permissible distance between a potential explosion site (PES) and an exposed site inside the explosive ordnance area.

Note: There are two types of IQD, inter magazine distance (IMD) and process building distance (PBD).

Inspection

A survey of explosive ordnance by qualified and authorised explosives inspection personnel to determine its condition.

Installed Explosive Ordnance

Any item of explosive ordnance (EO) that is fitted to a fixed or removable aircraft component to provide an energy source, eg to operate a mechanism.

Note: Installed explosive ordnance comprises:

a. Special-Role Installed EO, which is installed in the aircraft or its suspension equipment for specific missions, eg bomb ejector cartridges, suspension equipment jettison cartridges, fuel tank jettison cartridges, towed target release cartridges, gun recocking cartridges; and

b. Common-Role Installed EO, which is fitted to an aircraft for all roles and missions, eg ejection seat cartridges, canopy jettison cartridges, crew module ejection cartridges, fire extinguisher cartridges, engine starter cartridges, signalling cartridges, helicopter winch cartridges, survival packs complete with signal cartridges and small arms ammunition.

Instructional Ammunition

Inert replicas of ammunition (which may be sectioned) used for classroom instruction only.

Integrated Weapon Facility

An integrated system of explosives resistant barricades and shelters designed to protect other weapons, equipment and personnel from the effects of an accidental blast.

Notes:

1. Special equipment and techniques are incorporated in the design to minimise the possibility of fire and to propagate the effects of blast and fire away from working areas, eg heat, gas and debris.

2. The facility consists of Test Cells (TC) and Weapon Assembly Rooms (WAR) arranged symmetrically around a central test equipment house, which functions also as the safety citadel.

3. The citadel contains essential services for maintaining the safety and security systems in the event of accidental explosion, fire or electrical power failure.

4. General services are provided either locally at the test cells or in outlying plant rooms.

Interchange yard

An area set aside where a public carrier delivers or collects railcars or vehicles from a military installation.

Intrinsically Safe

Type of protection based upon the restriction of electrical energy within equipment and of interconnecting wiring exposed to an explosive atmosphere to a level below that which can cause ignition by either sparking or heating effects.

In-Use Life

The period of time a non-explosive consumable may remain fitted to a higher assembly. (This definition is not applicable to explosive ordnance and applies to non-explosive consumables only).

Isolation

Isolated Storage. The storage of explosives in an unsafe or possibly unsafe condition in separate licensed accommodation away from all other explosives.

J

L

Laboratory

See Process Building.

Levels of maintenance

1. **Operational Level Maintenance (OLM).** Includes tasks directly related to the preparation of equipment for immediate use and recovery, minor repair of the equipment after use. OLM tasks require a small range of support equipment and may involve the limited use of workshop facilities. Previously known as Organisational level by Navy.

2. **Intermediate Level Maintenance (ILM).** Covers maintenance carried out in a workshop, and normally consists of servicing, limited repair or replacement of damaged or unserviceable parts, components or assemblies.

3. **Deep Maintenance (DM).** Covers the most extensive maintenance that can be performed on an application or an item where the primary focus is asset preservation. It includes overhaul, repair of some complex items and tasks involving major disassembly and repair of an item as well as some servicing. DLM normally requires a wide range of special general support equipment and facilities. Previously known as Depot level by Navy.

Licensing Authority (LA)

Is the nominated Defence Group appointment responsible for the authorisation and issue of licences to operate and use an explosive ordnance facility.

Life Cycle

A time-based description of the events and environments an item experiences from manufacture to final expenditures or removal from the operational inventory.

Notes:

1. It includes one or more mission profiles and disposal or demilitarisation.

2. Also refer to Manufacture to Target or Disposal Sequence (MTDS).

Light Frangible Structure

The physical characteristics of an explosive ordnance storehouse that is built of light and frangible materials so that they will not produce dangerous debris at a potential explosion site.

Note: Buildings with walls of 230 mm solid brick or with 275 mm cavity brick walls are considered light structures for inter-magazine quantity-distance purposes.

Light structure

A light structure erected to protect a stack against weather.

Likelihood

Used as qualitative description of probability and frequency.

Limited Humidity Conditions

The conditions of atmospheric humidity required to minimise the absorption of moisture by hygroscopic substances.

Load

The process involving fitting or installing munition(s) from a: weapon, weapon system, platform or item of ordnance in such a manner that it is prepared for the future use of the munition in its intended design mode of operation but currently remains unable to be functioned due to one or more mechanical or electrical safety interfaces.

Lobbed ammunition, store or explosive ordnance

Unexploded ammunition that has been projected from an exploding stack and may explode on impact.

Logistical Certification

May be provided when all logistical issues which are necessary to provide through life support of the item of EO has been appropriately planned and supportable.

Note: The EO logical certificate (EOLC) documents the attainment of EO logistical certification.

Lot

A quantity of munitions, munition components or explosives, each of which is manufactured by one manufacturer under uniform conditions, and which is expected to function in a uniform manner.

Note: A lot is designated and identified by assignment of a serial number.

Low Explosive

An explosive substance which decomposes rapidly through combustion with the evolution of heat and flash, and generates a large quantity of gaseous products.

M

Magazine—*see also* explosive ordnance storehouse

An enclosure designed to protect certain goods of class 1 from damage by other cargo during loading and unloading and by adverse weather conditions when in transit, and to prevent unauthorised access.

Notes:

1. A magazine may be fixed or portable structure, a closed freight container or a load-carrying compartment of a closed vehicle.

2. Details for conversion of ISO shipping containers for use as magazines are contained in AS2187.1 Explosives – Storage, transport and use, Part 1: Storage, Appendix E.

Maintenance of Explosive Ordnance (EO)

All action taken to retain explosive ordnance (EO) material in or restore it to a specified condition.

Note: The need to retain EO in serviceable condition involves many different maintenance processes including repair, assembly/disassembly, scheduled/unscheduled servicing, testing, calibration, sentencing, reconfiguration and modifications.

Malfunction.

Any failure of an item of explosive ordnance (EO) to function as designed when fired, launched or otherwise activated, or when explosive components function during a non-functional test.

Manufacture to Target or Disposal Sequence (MTDS)

Identifies and documents the major events expected to occur in the life cycle of the explosive ordnance (EO) from development to operational use or disposal and generally consists of a logistical, tactical and disposal phases.

Notes:

1. An accurate identification of the MTDS provides the basis for the determination of the design certification basis.

2. EO has two distinct, but interrelated, phases of their MTDS.

3. EO spends most of its in-service life in the ‘off-platform’ phase where it is stored, maintained or disposed (separated from the platform) as apposed to when the EO is combined with the weapon/platform to complete its MDTS during the ‘on-platform’ operational phase.

Marking

Includes basic overall colours, role and hazard colour codes, as well as the descriptive markings and symbols which identify the explosive ordnance (EO) and indicate any special features.

Marking Drawing

A ‘marking drawing’ details the markings to be applied to particular EO.

Marshalling yard

An area within a military installation used for receiving, dispatching and switching of railcars or trucks.

Mass Detonating Explosives

Explosive ordnance which can be expected to detonate and consume most of the entire mass virtually instantaneously.

Mass explosion

An explosion which affects virtually the entire quantity of explosives under consideration practically instantaneously.

Note: The term usually relates to detonation, but also applies to deflagration when the practical effects are similar, for example, the mass deflagration of propellants under very strong confinement so as to produce a bursting effect and a serious hazard from debris.

Mass fire

A deflagration of the entire quantity of explosives under consideration under circumstances that avoid a bursting effect and a serious hazard from debris.

Note: A typical mass fire occurs in a few seconds at most, and produces extensive flame, intense radiant heat and minor projection effects.

Means of Ignition

A general term used in connection with the method employed to ignite a deflagrating train of explosive or pyrotechnic substances (for example: a primer for a propelling charge, an igniter for a rocket motor, an igniting fuze).

Means of Initiation

Any device used to cause a detonation of an explosive. Examples include blasting cap, detonator for ammunition and detonating fuse.

Misfire

Failure to fire or launch as intended.

Missile Preparation Area, Facility or Building

See Explosive Ordnance Preparation Area.

Moderate fire

A fire, comparable with that involving an ordinary commercial warehouse, which burns comparatively slowly and with a moderate flame radius, and from which some items may be thrown out for a short distance.

Modification

A formal, documented and systematic alteration to an item or process.

Monitoring

A process, conducted by technically qualified personnel from the Defence Groups, of ensuring compliance with Defence policy for the safe storage, transport and handling of explosive ordnance.

Monitoring authority

Is the designated senior executive appointed in writing by the group head as responsible for ensuring compliance by the Group with the provisions of Defence policy for the safe storage, transport and handling of explosive ordnance.

Note: The conduct of technical inspections/audits to ensure compliance with Defence policy may be delegated to a technically competent action officer/agency who is independent of the licensing and management authorities of the inspected facility.

Munition

A complete device, (eg missile, shell, mine, demolition store, etc.) charged with explosives, for use in connection with offence, or defence, or training, or non-operational purposes, including those parts of weapon systems containing explosives. Also refer to EO.

N

National Authority

All energetic materials within an item of EO are to receive EMQ prior to use within ADF service. As part of the STANAG 4170 - Principles and Methodology for the Qualification of Explosive Materials for Military Use (4 February 2008) agreement, each participating nation is to identify their appropriate National Authority (NA) for the EMQ for military use. The Director Ordnance Safety (D,OS) has been identified as the Australian EMQ NA.

Nature

A division of ammunition or explosive ordnance in accordance with the general properties of the filling, eg high explosive (HE), incendiary, smoke.

Negligent Discharge

When a weapon is fired through negligence on the part of the operator, either as a result of a negligent act or failure to apply the correct procedures/drills.

Net explosives quantity (NEQ)

The total explosives content of an ammunition, unless it has been determined that the effective quantity is significantly different from the actually quantity. It does not include such substances as white phosphorus, war gases or smoke and incendiary compositions unless these substances contribute significantly to the dominant hazard of the hazard division concerned.

Net Explosives Weight (NEW)

The total weight of all Class1 material in an item, stack of items, ship, vehicle, aircraft, cubicle or building.

Non-explosive Dangerous Goods (NEDG)

Items that are related by function to explosives and which are used for somewhat similar purposes as certain types of explosives.

Notes:

1. NEDG are by their nature hazardous and are classified as Dangerous Goods Class 2 to 9, as appropriate.

2. In the Service environment NEDG may be managed as if they belong to the Dangerous Goods Class 1, ie they are allocated a hazardous classification code for transportation purposes and may be stored in explosives storage areas in accordance with specific handling instructions for NEDG.

Noteworthy Risk

A risk requiring DAR or higher level of authority retention in accordance with the TAR-approved SSPP. Typically with a risk level equivalent to Medium or above, as defined by MIL-STD-882C.

O

Objective Quality Evidence (OQE)

The specified documentary evidence required to validate an item for a specific application.

Off-Platform

The Off-Platform phase includes:

1. The peace-time logistical storage and transportation (over land) of explosive ordnance (EO) in Australia in accordance with the provisions of eDEOP101.

2. Off-platform maintenance activities include: inspection, condition monitoring, servicing, repair, overhaul, testing, rebuilding, modifications and other workshop activities that are to ensure that EO remains serviceable for issue to user units.

3. The logistics disposal of EO by demolition or other types of demilitarisation.

On-Platform

The On-Platform phase includes:

1. For the land environment activities such as preparation, employment, carriage, loading/unloading to weapon systems aboard land platforms and emergency response across land on-platform activities.

Note: A soldier is to be considered a land platform when appropriate.

2. For the maritime environment activities such as stowage, transport and handling aboard maritime platforms, preparation for maritime employment, employment from maritime platforms and emergency response across maritime on-platform activities.

3. For the aviation environment activities such as preparation for air employment, loading/unloading/installation/stowage to aircraft, carriage and employment from aircraft and emergency response across aviation on-platform activities.

Operational Acceptance Authority

The appointment which is responsible for providing the ADF capability towards which an item of explosive ordnance (EO) contributes.

Operational Ammunition

All ammunition designed for use in operations as contrasted to practice ammunition that is used for training only.

Operational Life

The time for which materiel may be expected to remain safe and serviceable when used under its service or training conditions, when these are different from its storage conditions, but which is within the envelope of its lifecycle.

Operational Release

The acknowledgement by the relevant capability manager that a capability system or subset has proven effective and suitable for the intended role and that in all respects is ready for operational service.

Operating Environment

The total set of all external natural and induced conditions to which a system is exposed at any given moment.

Ordnance

A weapons system with its associated munitions and auxiliary materiel needed to fire a munition.

Ordnance Loading Apron (OLA)

An area on an airfield, authorised by a competent authority, where the loading and unloading of explosive ordnance to an aircraft stores delivery system, or the stowing of explosive ordnance in an aircraft is performed, or where aircraft containing explosive ordnance (loaded and/or stowed) may be parked and where sufficient explosive ordnance may be held ready for immediate loading and stowing.

Note: OLA are sometimes designated according to the aircraft type which is normally operated from that apron, eg fighter replenishment apron (FRA), bomber replenishment apron (BRA).

Outside Quantity Distance (OQD)

The minimum permissible distance between a potential explosion site (PES) and an exposed site outside the explosive ordnance (EO) area.

Note: There are three kinds of OQD including inhabited building distance (IBD), vulnerable building distance (VBD) and public traffic route distance (PTRD).

Outer Package

A box, barrel, case or cylinder of wood, metal, or other solid materials compatible with the contents, and of such strength, construction and character that it will not be broken or accidentally opened, nor become defective or insecure thereby permitting explosive items to escape during the normally expected Service conditions of storage and transportation of the contents.

Owner

The agency responsible for the provision of and maintenance of facilities and services in support of defence capability. The agency also carries the responsibility for construction and maintenance of electrical installations. Normally this is defence Support Group but may include other agencies as appropriate.

P

Package

Any form of box, container, cylinder, or frame containing explosive ordnance (EO) during storage or transportation.

Note: The package may comprise inner package which directly contains the EO, the outer package which is the normal package used for transit and storage, any package between the inner and the outer package which is designated the intermediate package, pallets and associated packing pieces if they form part of the primary package.

Pallet

A portable item of equipment affording a platform upon which goods may be placed to form a unit load for lifting by means of rigid forks or blades.

Particle velocity

The local velocity imparted by the transmission of a shock or a reflected wave.

Partition

A dividing wall in an explosive ordnance storehouse, process building or unit ammunition store, constructed from floor to roof without a gap and from wall to wall without openings; constructed of non-flammable material of strength equivalent to a brick wall not less than 230 mm thick.

Passive Surveillance

Those surveillance activities which are conducted for all explosive ordnance (EO) as part of systematic EO monitoring, such activities may include visual inspections prior to use or incident reporting.

Plant Room

A secure general purpose room, normally located in a non-hazardous area and typically used to accommodate building services equipment for electricity, air conditioning or plumbing used in the functioning of a large building.

Potential Explosion Site (PES)

The location of a quantity of explosives that will create a blast, fragment, thermal or debris hazard in the event of an accidental explosion of its content.

Potential Risk

Theoretical risk based on an assumption that an individual resides at a given location for 24 hours/day, all year.

Preparation Room

A room in a process building for the receipt and preparation of explosive ordnance before its entry into the work room for whatever subsequent operations are to be performed on the explosive ordnance.

Primary explosive

Substance, or mixture of substances used to initiate a detonation or a burning reaction.

Notes:

1. In their intended role, these materials are sensitive to a range of thermal, mechanical and electrical stimuli like for instance heat, impact, friction, electricity, and undergo a rapid reaction upon initiation.

2. Primary Explosives are used in initial or intermediary charges in devices such as primers, detonators, caps, relays, electric matches, etc.

3. To determine the conditions under which the explosive is to be used upstream or downstream of a barrier (interrupter).

4. Examples for primary explosives are lead azide and lead styphnate.

Probability

Probability is the likelihood of a specific outcome, measured by the ratio of specific outcomes to a total number of possible outcomes. Probability is expressed as a number between 0 and 1, with 0 indicating an impossible outcome and 1 indicating an outcome is certain.

Process Building (PB)

A building or area that contains or is intended to contain one or more of the following activities:

a. maintenance,

b. preparation,

c. inspection,

d. breakdown,

e. renovation, and

f. test or repair of explosives.

Prohibited Articles

Articles which are not permitted within an explosive ordnance area and/or facilities.

Projectile

An object, projected by an applied exterior force and continuing in motion by virtue of its own inertia, as a bullet, shell or grenade.

Projections

Overarching term for debris, fragments, non-metallic portions of the ammunition or its package, and lobbed ammunition.

Proof

The functional testing and assessment of the performance of explosive ordnance to determine its condition.

Propagation

1. Transfer of a reaction between explosives or munitions.

2. Transfer of a form of wave energy along a path.

Propellant

Substance or mixture of substances used for propelling projectiles, or to generate gases for powering auxiliary devices.

Note: When ignited, propellants burn or deflagrate to produce quantities of gas capable of performing the intended task. However, propellants are required not to undergo a deflagration-to-detonation transition in their application.

Protective roof

A roof reinforced with a 15cm concrete or its equivalent, designed to protect the contents of a building from projections.

Note: The roof should not collapse if the walls are damaged, except in the case of earth-covered structures.

Public Traffic Route (PTR)

A public traffic route is:

a. a road used for general public traffic;

b. a railway outside the explosive ordnance area which is used for public passenger traffic;

c. a waterway, such as a river having tidal water, and a canal used by passenger vessels, and other waterways where special consideration is warranted; and

d. taxiways and runways at joint user airfields.

Purple Line

The line on a safeguarding map showing the area in which buildings of frame and glass eg curtain wall construction, would be subjected to an enhanced risk of blast.

Pyrotechnic

Explosive stores generally containing combustible materials for the production of smoke, light, fire or sound, or a combination of these effects as a result of a non-detonative self-sustaining exothermic reaction.

Pyrotechnic substance

Energetic material designed to produce an effect of heat, light, sound, delay, gas or smoke or a combination of these as a result of a non-detonative, self-sustaining, exothermic, chemical reactions.

Q

Qualified Explosive

An explosive material that has successfully completed the Energetic Material Qualification (EMQ) process of a National Authority.

Quantity Distance (QD)

The minimum permissible distance between a potential explosion site (PES) containing a given quantity of explosive ordnance and an exposed site (ES). It is based on a tolerable risk to life and property from the effects of a mass fire or an explosion.

e. **Inside Quantity-Distance.** (IQD). There are two kinds of IQD as follows:

(1) **Inter-Magazine Distance (IMD).** IMD is the minimum permissible distance to be observed from a PES to any storage site containing explosive ordnance. This distance is intended to provide a specified degree of protection to the explosive ordnance at the ES; the degrees of protection are highly dependent upon factors such as sensitiveness of explosives, types of explosive ordnance, type of packaging, and the type and construction of the building at the PES or the ES or both.

(2) **Process Building Distance (PBD).** PBD is the minimum permissible distance between a PES and Process Buildings. This distance is intended to provide a reasonable degree of immunity for personnel within the process building from the effects of nearby explosion, such as flame, radiant heat, pressure and projections. In the event of an explosion however, light structures may be severely damaged at these distances from a PES.

f. **Outside Quantity-Distance (OQD).** There are three kinds of OQD as follows:

(1) **Inhabited Building Distance (IBD).** IBD is the minimum permissible distance between a PES and inhabited buildings, caravan sites or assembly places. This distance is intended to prevent serious structural damage by flame, blast or projections to ordinary types of inhabited buildings or caravans, thereby making consequential death or serious injury to the occupants unlikely.

(2) **Vulnerable Building Distance (VBD).** VBD is the minimum IBD between a PES containing explosive ordnance of Hazard Division 1.1 and buildings of Vulnerable Construction. VBD provide for larger IBD (normally $44.4Q^{1/3}$) so as to afford buildings of Vulnerable Construction a similar degree of protection to that for inhabited buildings of traditional construction, ie 230 mm solid brick or equivalent.

(3) **Public Traffic Route Distance (PTRD).** PTRD is the minimum distance between a PES and public traffic routes. This permissible distance is intended to protect the occupants of vehicles on the route from serious danger. Two sets of distances are used depending on whether traffic on the route is considered light or dense.

R

Radiation Hazard/Radio Frequency Hazard (RADHAZ)

The risk of inadvertent ignition of electro-explosive device and inflammables, injury to personnel or malfunction of safety critical electronic systems resulting from exposure to electromagnetic radiation environment in the frequency range emitted by radio and radar installations.

Ready-use Lockup

A facility outside a designated explosive ordnance area conveniently sited for the storage of explosive ordnance for immediate use.

Reliability

Reliability is the probability that an item will perform its intended function for a specified duration given specific operating conditions.

Repair

A process by which a non-conforming item is made to conform to the interchangeability and functional criteria previously specified.

Residual Risk

The remaining level of risk after risk treatment measures have been taken.

Restricted Electrical Area (REA)

An area containing explosive ordnance (EO) where the explosives substances are not exposed and an explosive atmosphere will not exist.

Ring Conductor

That part of the earth termination network that connects the earth electrodes to each other or to the down conductors.

Risk

The combination of frequency, or probability, and the consequences of a mishap.

Risk Acceptance

An informed decision to accept the likelihood and the consequence of a particular risk.

Risk Analysis

The systematic use of available information to identify hazards and to estimate the risk to individuals or populations, property or the environment.

Risk Assessment

The overall process of risk analysis and risk evaluation.

Risk Contour

The boundary of an area outside which the probability of occurrence of a hazardous event associated with the risk is less than some specified number.

Risk Control

That part of risk management, which involves the provision of policies, standards and procedures to eliminate, avoid or minimise adverse risks facing an enterprise.

Risk Engineering

The application of engineering principles and methods to risk management.

Risk Evaluation

The process in which judgements are made on tolerability of the risk on the basis of risk analysis and taking into account factors such as socio-economic and environmental aspects.

Risk Level

A qualitative or quantitative measure of risk, resulting from: an assessment of potential damage to equipment or personnel; sub-optimal completion of mission; and damage to morale, spirit de corps or professional image associated with each identified risk.

Risk Management

The systematic application of management policies, procedures and practices to the tasks of identifying, analysing, assessing, treating and monitoring risk.

Risk Reduction

A selective application of appropriate techniques and management principles to reduce either likelihood of an occurrence or its consequences, or both.

Robust Construction

This term refers to the physical characteristics of an explosive ordnance storehouse which has the following features:

a. a 150 mm thick concrete roof

b. 230 mm thick brick or concrete equivalent walls

c. no windows (unless protected by traverses)

d. metal doors, or fire resistant doors faced with metal; and

e. a concrete floor

Robust Shell

Those shells with an explosive content which does not exceed 20% of the total shell mass and with a shell casing sufficiently thick to prevent perforation by fragments produced by explosive ordnance of Hazard Division 1.1.

Round

A complete assembly of a projectile (with or without fuze), the propelling charge in a cartridge case, and the means of igniting the propelling charge.

S

Safe quantity Explosives (SE)

An area in laboratories and test facilities where very small quantities of explosives are prepared and tested by an authorised competent person and its ignition could not cause the subsequent initiation of other hazardous materials, significant damage to equipment or injury to personnel (Zone SE).

Safeguarding

Safeguarding is a process of planning which is designed to protect the utility of explosive ordnance facilities from encroachment by public development.

Note: The essence of safeguarding lies in the exercise of control over non-departmental land so as to prevent the construction of exposed sites which would restrict the operations of potential explosion sites.

Safeguarding map

An unclassified map depicting the safeguarding lines and zones for establishments which have licensed explosive ordnance activities.

Note: Safeguarding maps are unclassified, they do not identify potential explosion sites or the nature of any explosive ordnance related activity.

Safety and Suitability for Service (S3)

Summarises the requirements for explosive ordnance (EO) to be acceptably free from hazards and to have inherent characteristics that meet specified requirements during its agreed life cycle.

Notes:

1. Excludes operational effectiveness and lethality but may include certain performance characteristics if these aspects are deemed to be part of the item design function.

2. Within the ADF context, S3 is considered to be a subset of technical integrity.

3. Technical integrity incorporates S3 aspects plus environmental compliance.

Safety Certificate

Former title of explosive hazard data sheet (EHDS) within the UK and Australia.

Safety Critical

Applied to a condition, event, operation, process, or item whose proper recognition, control, performance, or tolerance is essential for safe system operation or use; eg safety critical function, safety critical path, safety critical component.

Safety Data Sheet (SDS)

Means a document that describes the identity, properties (that is to say chemical and physical properties and health hazard and environmental hazard information), uses, precautions for use, safe handling procedures and safe disposal procedures of a hazardous chemical.

Safety Management System

The organisational structure, processes, procedures and methodologies that enable the direction and control of the activities necessary to meet safety requirements and safety policy objectives.

Safety Risk Management

The application of safety systems in a risk management framework with the specific objective of preserving human resources or placing people first.

Salvage

The process of retrieving explosive ordnance for the purpose of repair, or of reclaiming serviceable or repairable components, and disposal of scrap.

Scheduled Servicing

Preventative maintenance carried out at predetermined intervals.

Screening Traverse

A natural ground feature, artificial mound or traverse which is capable of containing all projections inclined at 40 degrees or less to the horizontal is a screening traverse.

Notes:

1. The angle is measured from the top of the stack and the point furthest from the traverse site.

2. The primary purpose of a screening traverse is to protect personnel elsewhere from an accidental explosion within the confines of the traverse.

Secondary explosive

A substance or mixture of substances which is relatively insensitive and will detonate when initiated by a shock wave but which normally does not detonate when heated or ignited.

Notes:

1. As opposed to primary explosive.

2. The above definition applies essentially to fuzes. In this application, AOP-7 helps to determine the circumstances under which the explosive is to be used (upstream or downstream of a barrier, interrupter).

Security Incident

A security incident is any event that compromises security and/or breaches security regulations. Such events ie EO theft or loss, may be deliberate, negligent or accidental, and are often the result of a failure to comply with security policy as detailed in the Defence Security Manual (DSM).

Segregation

The act of having stored apart, but not necessarily in separate accommodation, explosive ordnance known to be other than serviceable but in a safe condition.

Self-propelled/Self-propelling

Self-propelled/self-propelling are the terms used to signify that an explosive item incorporates its own means of sustaining flight; it may also contain its own means of ignition.

Semi-fixed Ammunition

Ammunition where the projectile and cartridge are separate but in the same package.

Note: The user fits the projectile into the mouth of the cartridge that is a loose fit, before loading into the gun.

Senior Design Engineer (SDE)

A senior professional engineer within an AEO, responsible to the senior executive for overall adequacy of the engineering activities conducted by the AEO and for ensuring compliance with the regulations. The SDE is also authorised to approve significant design changes and to assign engineering authority to other competent personnel within the AEO. Overall responsibility for the Engineering Management System (EMS) is the responsibility of the SDE.

Within the Maritime TRF the most equivalent comparison is to a Level 2 Engineer. Within the Land TRF the most equivalent comparison is to a Level 5 engineer.

Sensitiveness

Sensitiveness: Safety of an explosive or explosive item: The probability or a measure of the ease of being initiated by a specified stimulus.

Notes:

1. Sensitiveness is an inverse measure of the safety of an explosive against accidental initiation, the probability of being initiated by unintended events.

2. For the assessment of the sensitiveness of an explosive or an explosive item, the no-free level is determined.

Sensitivity

Sensitivity: Suitability for service, reliability: A measure of the stimulus required to cause reliable functioning of an explosive system in the design mode.

Notes:

1. Sensitivity is the probability of being initiated by an intended action and a specified stimulus. For the assessment, the all-fire level is determined.

2. The expression of the sensitivity towards these actions depends on the equipment and the test procedure.

Sensitivity Analysis

Examines how the results of a calculation or model vary as individual assumptions are changed.

Sentence

A written decision as to the condition of explosive ordnance and/or ‘dangerous goods’ as the result of an inspection.

Serious structural damage

Damage which renders building uninhabitable and is not readily repairable.

Note: Examples are serious weakening or displacement of foundation, supporting walls, interior supports, side walls, floors or ceiling structures breaking numerous rafters or other important supporting members of roofs or floors.

Service Life

The time during which materiel, in specified storage conditions and when subsequently used in its specified operational and/or training conditions, may be expected to remain safe and serviceable.

Notes:

1. Where environmental monitoring equipment is used, the service life will depend on the environmental influences to which the material has been exposed.

2. The service life does not include the elimination from service, eg disposal.

Shelf Life

The period from the date of manufacture or cure date, as stipulated by the manufacturer, up to the date at which a non-explosive consumable is not to be applied or fitted for its intended purpose. Once the consumable has been incorporated into the weapon the `shelf life' restriction no longer applies.

Note: This definition is not applicable to explosive ordnance and applies to non-explosive consumables only.

Shifting Lobby

An entrance room in an explosive building divided by a barrier into a 'Clean Area' and a 'Dirty Area', in which personnel exchange their outer clothing for magazine clothing (and vice versa).

‘Side On’ Overpressure

The value of a blast wave without reflection.

Notes:

1. Minimum ‘face on’ pressure values are approximately double those for ‘side on’ because reflection occurs when the shock strikes evenly across the face of a building or other obstacle.

2. As the front moves across and around the building, the overpressure on the face drops off rapidly to the ‘side on’ value.

3. When the structure has been completely engulfed by the wave, the pressure exerted on all the walls and the roof will be approximately the same as ‘side on’ value.

Simultaneous Detonation

The detonation of two or more items or stacks of explosive ordnance which are in close proximity to one another, one item or stack detonating after the next within such a short time interval between detonations.

Notes:

1. the time in milliseconds is less than 4.15 times the cube root of the explosive weight in kilograms for lateral target positions and less than 5.9 times the cube root of the explosive weight in kilograms for axial target positions, that, for all intent and purpose, the overall detonation would appear to have emanated from a single item or stack.

2. Pressures produced by the independent detonations grow together (coalesce) within very short distances from their sources, this results in peak overpressures in excess of that of each independent source.

3. The pressure curve would be more nearly like that resulting from the total weight of explosives involved and would extend over a slightly longer time period.

4. The actual separation time between successive detonations is influenced by the spatial separation of explosives, geometry and distribution, the character of the dividing wall or other barrier between, and the sensitivity of the explosives.

Site

Sometimes used as shortened form of both potential explosion site and exposed site.

Small Arms

Firearms of small calibre including pistols, rifles, revolvers, machine guns, carbines and shot guns.

Note: The maximum calibre for small arms is 20mm.

Small Arms Ammunition (SAA)

Ammunition for small arms, ie all ammunition of less than 20 mm calibre, and all gauges of shotgun cartridges.

Small Quantity of Explosives

The net explosives quantity (normally less than 50kg) of various types of explosive ordnance that are permissible under the small quantity conditions prescribed in this manual.

Societal Risk

The relationship between frequency and the number of people suffering from a specified level of harm in a given population from the realisation of specified hazards.

Spall

Material, especially small pieces of rock, detached from a surface by the passage of a shock wave.

Spalling

The transmission of a shock wave through material that creates high-speed particles from the opposite face of that material without breaching it.

Spark Arrester

A device fitted to an internal combustion engine exhaust to prevent emission of hot particles or sparks from the exhaust system.

Note: This device will not prevent the emission of flame.

Special Precautions

Special Precautions is an EHA in an enclosed area where an exposed explosives substances is or may sublime (Zone SP). In the open the condensate will evaporate at a rate greater than the source because its surface area is much greater. Even when a build-up occurs, the quantities are typically micrograms and pose an insignificant risk. In this regard a typical bay/laboratory would be considered an open space. In closed situations this may not be true.

Special Protection Ex s

(Electrical Distribution) A concept which has been adopted in AS 1826 to permit the certification of those types of electrical equipment which, by their nature, do not comply with the constructional or other requirements specified for equipment with established types of protection, but which nevertheless can be shown, where necessary by test, to be suitable for use in prescribed zones or hazardous areas.

Stability

Explosives are liable to chemically decompose during storage, from the day they are manufactured.

Notes:

1. Such a change may effect their performance and in some cases can render them dangerous.

2. The resistance that an explosive exhibits to such change is broadly referred to as ‘stability’.

Static pressure

Static pressure is the pressure due to the mass and temperature of gases inside a structure after shock effects from an explosion have ceased.

Stockholder

A person who holds on charge the unit stock of explosive ordnance or a section of it, for issue as required in accordance with approved instructions.

Storage Life

The length of time for which an item of supply, including explosives, given specific storage conditions, may be expected to remain serviceable and, if relevant, safe.

Storage Module

One to five Basic Modules.

Storage Site

Several Storage Modules.

Stuffing

The placing of cargo and cargo bracing materials (dunnage) or other methods of restraint, if required, into a container.

Sub-station

An assemblage of equipment at one place including any necessary housing for the conversion, transformation or control of electrical power.

Surveillance

The constant review of accumulating test results to ensure that the overall quality remains acceptable. The term is also applied to the continuing examination of the stores themselves.

Suspect Explosive Ordnance

Includes explosive ordnance (EO) which is considered to be in an uncertain condition because it has been misfired, malfunctioned, dropped, deteriorated or damaged.

Sympathetic Detonation

Detonation of a charge by exploding another charge adjacent to it.

System

A combination of complete operating equipments, assemblies, components, parts or accessories, including software and man/machine interfaces, integrated to perform a specific operational function.

System Integrity

(Safety Systems) The ability of a system to function correctly whilst being subjected to potentially destructive internal or external influences, and to fail safely under these conditions.

System Safety

The application of engineering and management principles, criteria, and techniques to optimise the safety of a 'system', within the constraints of operational effectiveness, time and cost throughout all phases of the life cycle.

System Safety Program (SSP)

The combined tasks and activities of system safety management and system safety engineering.

System Safety Program Plan (SSPP)

A description of the planned tasks and activities to be used to implement the required system safety program. This description includes organisational responsibilities, resources, methods of accomplishment, milestones, depth of effort, and integration with other program engineering and management activities and related systems.

T

Technical Data

All recorded information of a scientific, technical and engineering nature relating to a weapon system. Includes specifications, standards, engineering drawings, instructions, reports, manuals, tabular data, test results and software documentation used in the development, production, in-service operation and logistics support (such as maintenance, provisioning, codification, testing and modification), and disposal of a weapon system.

Technical Integrity

An item's fitness for service, safety and compliance with regulations for environmental protection.

Technical Regulation

How Service Chiefs, as capability output managers, establish confidence in the processes by which the technical integrity of Defence materiel is achieved (adapted from DI(G) LOG 4-5-012). Technical regulation is based on the principles of Defence materiel being acquired, designed, manufactured and maintained:

1. to approved standards,

2. by competent and authorised individuals,

3. who are acting as members of an authorised organisation, and

4. work is certified as correct.

Technical Regulation Authority

The appointment or organisation authorised by a single Service Chief to issue instructions for the technical regulation of a nominated type of Australian Defence Force materiel.

Technical Regulatory Framework

The TRF establishes the technical integrity environment within which internal and external organisations are to provide ADF material and services to Defence.

Test

The planned assessment of an item for the purpose of determining suitability and/or reliability, by qualification, type, performance, endurance (see AS/NZS ISO 9000:2016 - Quality management systems - Fundamentals and vocabulary) or environmental.

Test Joint

A joint designed and situated to enable resistance or continuity measurements to be made.

Thin-skinned munitions

Metal cased munitions, eg artillery projectiles, aircraft bombs and the like, are considered to be thin-skinned for the purposes of storage if their mean diameter to mean wall (excluding the base and/or fuze receptor wall) thickness ratio (D/t) is greater than 10.

TNT Equivalence

TNT Equivalent: Method of quantifying the energy released in explosives in terms of the amount of TNT (trinitrotoluene) which could release the same amount of energy when exploded.

Note: The term 'TNT Equivalent' has traditionally been used to rate energy output and thus the destructive power of nuclear weapons, or from the explosion of a given quantity of fissionable material, in terms of the amount of TNT (trinitrotoluene) which could release the same amount of energy when exploded.

Transfer Facility

An area licensed where explosive ordnance changes mode of transport.

Notes:

1. Includes areas where loaded vehicles may be parked.

2. Includes shipping yards, transit areas, marshalling yards, transhipment areas, staging areas and the like.

Transportation Explosives Quantity (TEQ)

Regarded to be the total amount, in kg, of explosive substances or, in the case of explosive articles, the total amount of explosive substances contained in all articles.

Notes:

1. In this instance the total explosives quantity is referred to as the transportation explosives quantity (TEQ).

2. TEQ is the ‘net explosives quantity’ referred to in the Australian Code for the Transport of Explosives by Road and Rail (AE Code).

Traverse

A natural ground feature, artificial mound, barricade or wall which is capable of intercepting high velocity low angle projections from a PES and preventing initiation of explosives stocks stored nearby. It may be destroyed in the process.

Truck Holding Area

See Transfer Facility.

Type

A division of ammunition and explosive ordnance in accordance with its general design and role, eg AP, SAP, Nose Ejection.

Type (or Final) Qualification

Type or Final Qualification relates to the use of the explosive material in a specific application or munition. Final Qualification is given when the explosive has been assessed as part of the design of the specific munition, and predicted to be safe and suitable for military operation or training use in that role.

U

Unauthorised Discharge.

An occurrence where a person intentionally and without authorisation discharges small arms ammunition (SAA).

Note: Any unauthorised discharge of a weapon system or explosive ordnance (EO) that is not SAA is to be treated as an accident or dangerous occurrence.

Underground petroleum, oil, lubricant (POL) tank

POL tank with a minimum cover of 1.2 m earth or 10 cm of concrete.

Underground pipeline

Pipeline (petroleum, oil, lubricant (POL), gas, water etc.) with a cover of at least 1.2 m of earth or 10 cm of concrete.

Underground storage

Cavern excavated into solid rock, for the purpose of storing ammunition and explosives.

Unexploded Explosive Ordnance (UXO)

Explosive ordnance which has been primed, fused, armed, or otherwise prepared for action and has been fired, dropped, launched, thrown, projected or placed in such a manner as to constitute a hazard to operations, installations, personnel or material and remain unexploded either by malfunction or design or for any other cause.

Unit load

A unit load is a load designed to be carried, stored and handled as a separate unit and able to withstand the conditions associated with the appropriate modes of transport, and comprising a number of packages or articles which are either:

a. placed or stacked on, and secured to, a load board such as a pallet;

b. placed in a protective outer packaging such as a pallet box; or

c. permanently secured together in a sling.

A single large package such as a tank-container, intermediate bulk container or freight container is specifically excluded.

Unit Returns/Receipts

Explosive ordnance and associated non-explosive stores returned from a user unit to an ammunition depot are known as unit returns/receipts.

Unload

The process involving removal of all munition(s) from a weapon, weapon system, platform or item of ordnance.

Notes:

1. This includes removal of the subject munition from platform and weapon system magazines.

2. Unload changes the state of the weapon system by removing the ability to employ the munition ie removal of round from rifle chamber and removing the magazine containing rounds from the rifle will unload the rifle.

Unsatisfactory Materiel

Unsatisfactory materiel is anything that fails to meet the user's needs, but which is not defective and does not malfunction. The item may function fully in accordance with the design specification, but the operating environment might have changed to such an extent that the design no longer fulfils the role for which is was intended. Platform/launcher issues are to be reported through the appropriate single-Service materiel reporting system.

Unscheduled Servicing

Corrective maintenance identified as the result of condition monitoring.

Unserviceable Ammunition

Ammunition considered unsatisfactory for use.

User Unit/ Occupier

The ultimate responsibility for the hazardous area classification installation generally rests on the occupier (or employer) since the owner may not be the occupier.

Note: May delegate a person to classify the hazardous areas; however they must ensure that the delegated person is ***competent*** to carry out the task.

Unstuffing

The removal of cargo and cargo bracing materials (dunnage) or other methods of restraint from the container.

V

Vapours and Gases of Explosives

Vapours and gases that are inherently explosive, as they have their own oxidant and are hazardous whether airborne or not.

Vulnerable constructions

Buildings of vulnerable construction are of four main types as follows:

a. **Type 1.** A building of **curtain wall construction** which has four storeys or more and is constructed with external non load-bearing panels on a separate sub-frame which is supported off the structural frame or floors for the full height of the building. Where these cladding panels are large (greater than 1500 mm square) and constructed of glass or similar lightweight frangible material, which is liable to shatter producing debris or be displaced under the effect of lateral explosive blast loads greater than the designed wind forces, the curtain walling would be considered a hazard to personnel both inside and outside the building because of flying debris or falling panels.

b. **Type 2.** A building of **largely glass construction** which has four storeys or more and has more than 50 per cent of its wall area glazed.

c. **Type 3.** The third type of **vulnerable construction** is impractical to define precisely. This covers any large building which employs non load-bearing cladding panels, eg glass-covered market gardens or warehouse type retail stores. The explosion effects on such buildings depend on many factors, including:

(1) The mass per unit area and frangibility of the cladding material.

(2) The detailed design of the frame structure including stiffening partitions.

(3) The use to which the building is dedicated.

(4) The local population inside and outside the building.

Note: Definition of this type of construction cannot be more precise, because of the variation in types of modern structures and the complexity of the interaction of the factors given. There is no real alternative to individual assessment of any large building within two times inhabited building distance (ie 44.4 $Q^{1/3}$) which is not of traditional house construction.

d. **Type 4.** Sensitive Structures. Building structures that may in themselves be susceptible to disproportionate damage (eg collapse, partial collapse or progressive collapse) including:

(1) unframed structures with limited continuity utilising non-ductile materials.

(2) large-span, tension or other special structures with critical load-bearing elements.

(3) usually weak structures (typically historic or timber framed buildings).

(4) buildings containing vulnerable elements such as pre-cast panel fixings, large span slender masonry panels which may be particularly susceptible to failure and lead to a falling debris hazard.

As a general guide, buildings that stand out either dimensionally or by construction type against a normal background of houses should be subject to closer examination. Cases that fall within or near the vulnerable construction guidelines above, or where it is suspected that they may be particularly vulnerable to blast, require an assessment of the potential risks.

W

Waiting Position

A site used for the temporary parking of vehicles containing explosive ordnance to provide ready-use stock for processing in a workshop, or as an assembly point to accumulate explosive ordnance before return to storage.

Waivers

The term waiver is no longer relevant in the context of conducting explosive activities Review of the DEOP 101 to align with WHS act 2011 means this term is now deemed a deviation. See Regulation 1.2 - Deviations from Mandatory Explosives Safety Requirements

Warhead

The portion of a projectile, rocket, missile or torpedo which contains the payload to be delivered.

Note: Generally, the payload is explosive, but it may contain telemetric or components.

Weapon System

The aggregate of the weapon, the associated launching vehicle or platform launching the munition, the available munitions and the ancillary equipment necessary to aim, launch and guide the munition, as applicable.

With a propelling charge

With a propelling charge indicates that the propelling charge is assembled to the projectile or packed with the projectile in the same package, or palletised with the projectile on the same pallet.

With its (own) means of initiation

Expression used to describe ammunition which has its normal initiating device, such as a detonator or detonating fuze, assembled to it or packed with it, and this device is considered to present a significant risk during storage and transport, but not one great enough to be unacceptable.

Without its (own) means of initiation

Expression used to describe ammunition without its normal initiating device assembled to it or packed with it. The expression also applies to ammunition packed with its initiating device, provided the device is packed so as to eliminate the risk of causing detonation of the ammunition in the event of an accidental functioning of the initiating device. In addition, the expression applies to ammunition assembled with its initiating device, provided there are protective features such that the initiating device is very unlikely to cause detonation of the ammunition under conditions that are associated with storage and transport. For hazard classification purposes, a means of initiation that possesses two independent effective protective features is not considered to present a significant risk of causing the detonation of the ammunition under conditions associated with storage and transport.

Working Area/Work Room

The actual area or room in a process building in which the inspection, repair or modification of explosive ordnance is authorised to take place.

Y

Yellow Line

A continuous line drawn on the map or plan of an ammunition storage location which encompasses the explosives area and defines the minimum permissible distance between a potential explosion site and inhabited buildings, caravan sites or assembly places.

Notes:

1. A line at inhabited building distance (IBD) within which the construction of new inhabited buildings, caravan sights and public traffic routes are restricted.

2. The area within the yellow line is known as the yellow zone.

Z

Zone 0E

An area in which the vapour or gas of explosives is present continuously, or for long periods or frequently.

Zone 1E

An area in which the vapour or gas of explosives is likely to occur in normal operation occasionally.

Zone 2E

An area in which the vapour or gas of explosives is not likely to occur in normal operation but, if it does occur, will exist for a short period only.

Zone 20E

An area in which the dust of explosives is present continuously, or for long periods or frequently.

Zone 21E

An area in which the dust of explosives are likely to occur in normal operation occasionally.

Zone 22E

An area in which the dust of explosives not likely to occur in normal operation but, if it does occur it will exist for a short period only.

Zone 33E

An area in which an explosive substance will be exposed to the atmosphere and in which the vapour or gas of explosives will not occur and the dusts of explosives will not occur.

Zone SE

See Safe quantity Explosives

Zone of Protection

The portion of space within which an object or structure is considered to be protected from a direct strike by an LPS.

AMENDMENTS

Users of this manual are encouraged to submit details of any errors, omissions or discrepancies and recommend suggestions for improvements, to the publication Sponsor via Form AO 011 – Publication Improvement Report and Reply. Form AO 011 is to be emailed to DOS.Publications@defence.gov.au

Amendment Number	Section/Regulation/Procedure	Amendment	Effective Date
6.0	Section 1, Regulation 1.3	Updated policy for Sentinel reporting and role of JEOS.	13 MAY 2021
7.0	Section 2, Regulation 2.4 and 2.5	Updated policy for Inert EO safety and EO life management	27 JUN 2024
8.0	Section 1, Regulation 1.2	Updated policy, Deviations from Mandatory explosives safety requirements	10 OCT 2024

REGULATION 1.1 - TRAINING OF PERSONNEL

General Overview

1.1 Personnel whose duties are in any way concerned with Explosive Ordnance (EO), including associated components, packaging and non-explosive dangerous goods, must be adequately trained in all aspects of the tasks they are required to perform in order for the work to be conducted safely and effectively.

Requirements

1.2 All training for EO activities, both for uniformed and civilian personnel, is to be competency based against nationally approved standards, utilising national approved packages where possible.

1.3 An approved training system and its associated documentation and procedures is to be used when developing, conducting and assessing training. Australian Defence Force (ADF) members are to be trained in accordance with applicable Service approved training systems.

Responsibilities

1.4 Defence People Group is responsible for training policy within the Department of Defence.

1.5 Defence training authorities are responsible for defining, developing and coordinating all training of uniformed personnel involved in EO activities.

1.6 Individual Department of Defence elements, branches and services providers are responsible for defining, developing and coordinating all training of civilian personnel involved in EO activities.

1.7 Project Directors will be responsible for making provision for initial training when major items of EO are introduced into service.

1.8 Workplace Supervisors, in consultation with Officers-in-Charge, are responsible for ensuring that authorisation requirements for all personnel are defined.

Procedures

1.9 The Procedure used to implement the requirements of this regulation is Procedure 1 – Training and Authorisation of Personnel.

PROCEDURE 1 - TRAINING AND AUTHORISATION OF PERSONNEL

Introduction

1.1 Personnel whose duties are in any way concerned with Explosive Ordnance (EO), including associated components, packaging and non-explosive dangerous goods, must be adequately trained in all aspects of the tasks they are required to perform in order for the work to be conducted safely and effectively. This applies not only to personnel handling, storing, transporting, maintaining or using EO and associated stores, but also to personnel involved in policy, design and engineering aspects. The competence of personnel must be assessed normally at their workplace and their competence to perform the task must be recognised by a formal authorisation system. Individuals and Workplace Supervisors should work together to develop appropriate training strategies that meet workplace and individual needs.

Purpose

1.2 This procedure specifies the requirements for training and authorisation of personnel for EO activities.

TRAINING OF PERSONNEL

Objective

1.3 The objective of training is to equip personnel with the necessary knowledge, skills and attitudes appropriate to their duties. Training should be aimed at three levels which:

a. Are essential for the conduct of duties;

b. Benefit the organisation by improving staff skills and thereby enhancing flexibility in employment and greater job satisfaction; and

c. Help individuals develop greater skills, improve career prospects or prepare them for future employment.

1.4 While task essential training (paragraph 1.3a) must be given priority, a reasonable allocation of resources should be given to the desirable levels of training (paragraphs 1.3b and 1.3c). Once trained, the new skills should be maintained by applying the skills in the work place and periodical assessment.

Policy

1.5 All EO and associated training is to be competency based against nationally approved standards, utilising nationally approved packages where possible. Australian Defence Force (ADF) members are to be trained in accordance with applicable Service approved training systems for EO training and for all ADF Weapons Systems including any associated munitions. Training for EO activities, both for uniformed and civilian personnel, is to comply with the same principles. An approved training system and its associated documentation and procedures is to be used when developing, conducting and assessing training.

Implementation

1.6 Chief of Joint Capabilities (CJC) is the policy owner for ADF specific learning and development policy common to the three Services and is responsible for managing people learning and development requirements of the Joint Capability group (CJG). Service Chiefs and Group Heads are responsible for managing learning and development for their Defence members to ensure that Service/Group specific and relevant whole of Defence requirements (including EO training) are met. All EO training must address explosives safety requirements, including hazards of different types of explosives, precautions when handling, transporting, maintaining, testing and storing EO, and electro-explosive hazards. EO training is also to include the following aspects, as appropriate, for each person’s classification and duties:

a. Explosives storage regulations and procedures, as laid down in this publication and other Defence instructions and publications.

b. Technical training for maintenance, testing and inspection of EO, ordnance, small arms, associated components and non-explosive dangerous goods.

c. EO accounting and inventory managements systems, eg COMSARM.

d. Other specialists training eg ship magazine compliance inspection and certification.

1.7 General training is also to be defined, as appropriate, including:

a. Work, Health and Safety requirements.

b. Quality systems, quality control and quality assurance.

c. Computer skills.

d. Administration, including personnel management.

1.8 Training programs are to be developed which will:

a. Identify the essential training requirements, both for subject matter and level of knowledge, for personnel to perform their assigned tasks safely and effectively (paragraph 1.3a):

b. Identify the desirable training requirements to meet the objectives of paragraphs 1.3b and 1.3c;

c. Identify the sources of training to meet those requirements, such as;

(1) In-house training courses conducted by qualified instructors;

(2) External training courses provided by Defence training authorities, overseas, State education systems, or commercial training organisations; and

(3) Structured on-the-job training (OJT) provided by experienced supervisors and qualified workplace trainers.

d. Provide adequate resources to meet the essential and as far as possible, the desirable training requirements;

e. Provide a system of review for training courses content;

f. Specify the requirements for follow-on training and assessment such as:

(1) When a change occurs in equipment build standard or working procedures;

(2) When staff are required to perform tasks which have not been carried out for long periods; or

(3) On a routine basis, if considered appropriate; and

g. Provide assessment guides and assessment instruments to be administered by qualified workplace assessors during Recognition of Prior Learning (RPL) and Recognition of Current Competence (RCC) workplace assessments of personal competence.

1.9 The training program should identify the preferred sources of training (paragraph 1.8) and, whenever possible, alternative sources. It should be sufficiently flexible to allow recognition of prior learning and experience of individual personnel, eg ex Service personnel.

1.10 Project Directors will be responsible for making provision for initial training when major items of EO are introduced into service. This will include, in consultation with Defence training authorities, arranging for the necessary information transfer to enable follow-on training to be developed and conducted.

1.11 Personnel who design, manage, conduct and evaluate training, either full time or as a part of their duties, are to be trained in the following aspects as appropriate for each person's duties:

a. Training management,

b. Training analysis and design,

c. Instructional techniques,

d. Workplace assessment, or

e. Training quality control.

1.12 Defence training authorities are responsible for pre-requisite training for ADF personnel. To obtain maximum usage of EO training and avoid duplication, all training courses developed for, or applicable to, ADF personnel should be allocated course numbers and included in the training programs published by the Defence training authorities.

1.13 Training requirements are to be reviewed periodically or when there are changes to working conditions or equipment configuration, eg Operational Specification (OPSPEC).

1.14 Records are to be kept of all relevant training completed by all personnel, including externally conducted courses. Individuals should be given certificates, Statements of Attainment or equivalent, recording their completion of training.

Workplace Competencies and Qualifications

1.15 Following completion of training, personnel must complete a workplace competency assessment. The workplace assessment is to be conducted by a certified workplace assessor and demonstrates the assessee's ability to carry out the assigned duties safely and effectively. Individuals are to be issued with a Competency Logbook or have the completed training outcomes entered into PMKEYS, in which to record training they have undertaken and competency attainment. Individuals are responsible for ensuring that their training and competency records are accurate.

1.16 For any additional competencies and qualifications required to be added to their base trade skill set, personnel should consult with their unit's training officer. The training officer should make available information for, and assist in the identification of, the applicable competencies and the level and scope of qualifications to be gained for particular duties[1].

1.17 Information on specific competencies and qualifications may also be gained from the Public Safety Training Package (PUA12) available from the training.gov.au web site.

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[1] Training Officers should have access to the Defence Explosive Ordnance Competency Standards Training Package prepared in accordance with Australian National Training Authority guidelines. These Competency Standards describe the skills, knowledge and on-the-job performance required by Defence EO staff engaged in work within, or behalf of the Department of Defence, to effectively perform their duties.

AUTHORISATION OF PERSONNEL

Responsibility for Authorisation

1.18 On successful completion of the workplace competency assessment personnel are to be authorised by Workplace Supervisors before being employed in their assigned duties.

Defining Authorisation Requirements

1.19 Authorisation procedures are to be detailed in the organisation's quality management system/Standard Operating Procedures. Workplace Supervisors, in consultation with Officers-in-Charge, are responsible for ensuring that authorisation requirements for all personnel are defined, including:

a. The type and number of tasks to be completed under supervision;

b. The level of supervision required;

c. The circumstances under which authorisation may be withdrawn or lapse, such as:

(1) The expiry of a training course qualification period,

(2) After a specified period away from a particular area of activity,

(3) When a major change occurs in equipment build standard or working procedures, or

(4) When the necessary standards of safety and quality are not met; and

d. Task authorisation requirements.

Periodical Reviews

1.20 Authorisation and assessment requirements are to be reviewed periodically by the Workplace Supervisor in consultation with the Officer-in-Charge, or if there are changes to working conditions or equipment configuration.

Recording of Authorisations

1.21 Records are to be kept by the Workplace Supervisor of all authorisations awarded to all personnel including the occasions when authorisation lapses or is withdrawn.

REGULATION 1.2 - DEVIATIONS FROM MANDATORY EXPLOSIVES SAFETY REQUIREMENTS

Regulation 1.2: (Intent) Any Deviation from explosive safety requirements detailed in this manual **must** be independently reviewed by a Subject Matter Expert (SME) to ensure that decision-makers are appropriately informed on explosives hazards and controls before a non-compliant activity can be approved to proceed.

General Overview

2.1 The DEOP 101 Department of Defence Explosives Regulations sets out the policy, procedure and guidance for controlling the hazards and risks associated with handling[1] of Explosives related to Defence activities. Occasions may arise when circumstances and operational imperatives warrant the performance of activities which do not comply with the requirements[2] prescribed in this manual. Where personnel intend to complete activities and they cannot comply with the requirements prescribed in this manual, the risks inherent in handling Explosive Ordnance (EO) may be greater than those resulting from the application of the known controls identified in this manual.

Requirements

2.2 The requirements of this Regulation **are to** be read and complied with in conjunction with other relevant Defence policy, including SAFETYMAN, DI ADMIN POL and DEOP100.

2.3 Where the mandated requirement cannot be fully met, Applicants **must** apply to an Executive Authority through the relevant Group or Service Risk and Safety Management System process for a Deviation for an authorised departure from policy for the activity. Authorisation for a Deviation **must** be issued by an Executive Authority, and approved or amended controls implemented, before the performance of the related activity which does not comply with the requirements identified within this manual.

2.4 Where the content of a proposed Deviation includes controls from Section 3 or Section 5 of this manual, Executive Authorities **must** receive advice from the Explosive Ordnance Safety Regulator (EOSR).

Note: Section 3 contains legislative requirements that can only be approved by the Commonwealth Competent Authority. Deviations from requirements in both Sections 3 and 5 may have a significant impact upon the risk exposure of non-involved personnel (encompassing all classes of non-involved personnel – Defence, contractors and public) for EO activities.

2.5 **Deviation for Activities undertaken by Defence Contractors.** Contractors **are required to** seek a Deviation where activities are planned to be undertaken in support of Defence where DEOP 101 is a contractual requirement.

2.6 Defence contractors cannot directly apply for a Deviation but **must** submit applications through their contracting authority. For further guidance on the implementation of this policy and explosive safety risk subject management expertise DOS-JLC should be consulted.

2.7 **Considerations before Applying for a Deviation.** When considering the appropriateness of the need for a Deviation, Applicants will need to demonstrate compliance with Defence WHS policies and Commonwealth legislation throughout the Deviation process:

a. There are no reasonably practicable alternatives to seeking a Deviation approval.

b. All hazards associated with the activity (particularly in the context of the Deviation) have been considered and eliminated so far as reasonably practical.

c. All risks associated with the Deviation have been assessed and minimised so far as

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[1] For the purpose of this manual, 'handling' has the same meaning as in the Explosives Act 1961 i.e. 'handling' includes loading, unloading, discharging, stacking, stowing, storing, transporting and any operation incidental to, or arising out of, any of those operations.
[2] Requirements are identified by the use of the words m***ust*** and ***is to/are to****.*

reasonably practicable.

d. All controls have been documented and appropriate consultation and coordination with stakeholders has been completed.

e. All reasonable future options to remedy the need for a Deviation have been identified and resourced within an appropriate plan.

f. Appropriate plans for monitoring and reporting for controls are in place and agreed with stakeholders.

2.8 Applicants who are raising a Deviation request should consult their Executive Authority about the proposed departure from DEOP101 requirements. Applicants may consult with the EOSR for any matters should they deem it appropriate.

2.9 Impacts on associated explosive limit licenced facility. Where a Deviation is being sought that will impact on the licence of a storage facility, the relevant Licencing Authority **must** be consulted. When a Deviation is issued that impacts on a licence, the licence **is to** be reissued with the details of the Deviation and the alternative controls recorded on the facility licence.

2.10 Management of Deviations. Deviations **must** be actively managed throughout their period of currency. Management of Deviations **must** consider:

a. **Changes to Deviations.** If the conditions under which a Deviation has been issued have changed, the Applicant **is to** notify the Executive Authority of the change/s and any implications to the original Deviation application as soon as reasonably practicable once the change in conditions is known or a possible change is suspected. The Executive Authority will then provide direction as to any requirement to update the original safety argument developed in support of the Deviation.

b. **Activities inconsistent with Deviations.** With the exception of operational capability requirements, if an already approved activity is determined to be non-compliant with the conditions of that Deviation then it **must** cease immediately. Notification of any breach of safety provisions **is to** be in accordance with the Group or Service safety management system.

c. **Operational Capability.** Where the activity has an identified immediate operational capability requirement, Applicants may continue operations in a manner consistent with their obligations under the WHS Act 2011 – eliminating hazards and minimising risk so far as reasonably practicable and managing controls. Incident reporting **must** follow. Should such operational circumstances be required across a longer term, a continuation **must** be sought from the Executive Authority.

d. **Cessation of Deviation.** Deviations remain valid for the period for which they were approved. Once a Deviation period has expired, the requirements of this manual **are to** be complied with. If the conditions remain such that the requirements of this manual cannot be complied with, then a new Deviation **must** be sought. Should the situation occur during the period that a Deviation is granted that the requirements of this manual can be complied, without the need for a Deviation, the Executive Authority **is to** be notified and the Deviation cancelled.

Deviation applications for review by the EOSR

2.11 Deviation applications **are to** be raised and submitted to the EOSR only after the need for the non-compliant activity has been confirmed. Applications for a Deviation **must** articulate the following in writing:

a. The Group and Services’ safety risk management policy used to determine residual risks and identify the appropriate executive authority for approving the activity.

b. The reason for seeking a Deviation and if other options are available, such as, alternative handling locations and/or modified storage and licence arrangements.

c. Whether a proposed departure from DEOP 101 is reasonable and justified in the circumstances and whether it will produce a better holistic safety outcome for Defence.

d. The work activity to which the proposed Deviation will relate and alternatives that were considered but rejected.

e. A clear understanding, including costs and timings, of the measures that are being proposed.

f. The consequences of the Deviation application not being supported.

g. The period sought for the proposed Deviation.

h. The outcome of the risk assessment process and the proposed control measures to demonstrate protection for exposed personnel, infrastructure and the public including any assessment of any increase in hazard involved and likely consequences. This process **must** be included in an application.

i. The consultation that has been carried out in relation to the proposed Deviation with workers and other duty holders.

j. A full disclosure of the aggregate net explosives quantity involved.

k. An explanation of the consequences of possible stock losses to operational readiness, monetary costs and replacement lead times in the event of an accident.

l. The emergency management provisions that will be enacted in support of the activity.

m. Methods, plans and reporting for ensuring controls are monitored and consistent with the Deviation application throughout the period of the Deviation.

n. Where the application includes Deviation from element/s of Section 3 the following is also required in accordance with Commonwealth Explosives Transport Regulations (2002):

   (1) State the applicant's name and address.

   (2) Specify the provision, or each provision, of the Explosive Transport Regulations 2002, and, if applicable, of the AE Code[3], to which the application relates.

   (3) State whether the Deviation is to apply only to a specified person or to every person included in a class of persons who might otherwise be bound to comply with the provision or provisions.

   (4) Specify the Commonwealth explosives to which the application relates.

   (5) State the reasons why the Applicant thinks that the Deviation is necessary; and sets out details of how the applicant proposes to ensure that the explosives will be handled in a way that:

      i. reduces so far as reasonably practicable the risks of personal injury, property damage and environmental harm arising from the transport of Commonwealth explosives by road and rail and the risk of that transport endangering public safety; and

      ii. ensures their security.

   (6) If the application relates to a vehicle, equipment, packaging or other thing – describe the thing.

[3] Australian Code for the Transport of Explosives by Road and Rail, Edition 3, 2009.

(7) State the period for which the Deviation is sought (not more than 12 months).

(8) State the geographical area within which the Deviation is to apply.

2.12 Approval by Executive Authority: After receipt of the EOSR's advice, the Application shall be forwarded to the relevant Group or Service Executive Authority for consideration. The EOSR's assessment of the Deviation **must** accompany the Application. The Application **must** then be processed in accordance with the provisions of the Group or Service Safety Management System.

2.13 Copies of Applications. Information copies of Applications **are to** be provided to the Directorate of Ordnance Safety—Joint Logistics Command (DOS–JLC):

a. After they have been considered by Executive Authorities.

b. When changes and cancellations to Deviations have been enacted.

REGULATION 1.3 - EXPLOSIVE ORDNANCE INCIDENTS

Regulation 1.3: (Intent) Incidents involving Explosive Ordnance are required to be reported to enable analysis and action necessary to fulfil Defence's commitments to Safety.

Introduction

3.1 Explosive Ordnance (EO)[1] when handled or utilised incorrectly or by manufacturing defect may become unsafe or unreliable and result in an incident. Incidents involving EO can, and do, occur at any point during the EO life-cycle and it is essential that all incidents are appropriately reported, investigated and managed in order to determine root causes and prevent recurrences.

3.2 The effective and efficient reporting, investigation and management of EO Incidents will reduce the risk of reoccurrence. Conversely, failure to report and manage an EO incident may increase the probability of:

a. Fatalities or injuries.

b. Damage to equipment and infrastructure.

c. Degradation of Defence operational, enabling and sustainment capabilities.

Applicability

3.3 This Regulation and its subordinate procedures apply to all Defence personnel and contractors (where it is a term of their contract) either within or outside Australia, during operational or enabling and sustainment activities. Failure to comply with the mandatory aspects of this section may result in administrative or disciplinary action.

Requirements – Immediate response

3.4 In the event of an EO incident, appropriate response procedures are to be implemented as soon as practicable. Direction and guidance can be found in the Defence Incident Scene Initial Action and Preservation Manual (DISIAPM), range regulations, Standard Operating Procedures (SOP) or Unit Instructions. Procedure 1 provides guidance on emergency response considerations and requirements.

Requirements – EO incident reporting

3.5 **Background.** All EO incidents[2] and associated incidents involving EO[3] that occur either within or outside Australia are to be reported in accordance with the relevant Defence policies, instructions and external agency requirements.

3.6 **Additional EO incident reporting.** In addition to the relevant Defence policies, all EO incidents are to be reported to the appropriate Groups and Services. The Groups and Services will subsequently report the incident to the Explosive Ordnance Incident Administration Cell (EOIAC) within the Directorate of Ordnance Safety (DOS), Explosives Ordnance Branch (EOB), and Joint Capabilities Group (JCG) in accordance with Procedure 1.

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[1] In addition to the NATO EO definition found in the Glossary of terms, in the context of EO incident reporting, this includes related EO items and components that are non-explosive (inert) in nature (including containers and packaging) and pertains to EO that is in the possession or under control of Defence or is used in a Defence activity.

[2] Where the event can be attributed to ammunition or EO in use such as an accident, near miss, malfunction or defect.

[3] An event that involves ammunition or EO, does not meet the classification as an EO, but is reportable due to security or procedural breaches.

3.7 This additional reporting requirement covers EO that is in the possession or under the control of Defence or is used in a Defence activity. In this context, an EO incident includes the following circumstances:

a. **EO accident.** An accident is an unplanned, unintended, unexpected and/or undesired event, or series of events involving ammunition or EO, which results in:

(1) Death, injury or occupational illness,

(2) Substantial damage to the environment, or

(3) Damage to equipment or property, regardless of ownership.

b. **EO near miss.** An EO near miss is an event where no person is injured or property significantly damaged, but the event is worth analysing as:

(1) Any repeat occurrences may result in an accident, or

(2) The event may indicate a wider problem requiring investigation and possible remedial action to mitigate the potential of another event occurring.

c. **EO malfunction.** A malfunction is a failure of an item of ammunition or EO to function as expected when fired, launched, or otherwise activated, or when explosive components function during a nonfunctioning test[4]. Malfunctions include abnormal or premature functioning of an item of ammunition or EO as a result of normal use, handling, maintenance, storage and transport that does not result in an EO accident.

d. **EO defect.** A defect is any fault in the make up or marking that may cause a failure in the performance; or any deterioration or damage to the physical state of the ammunition or EO or its container. The defect category can also include circumstances where EO is no longer deemed fit for purpose and fails to meet the user's needs.

e. **EO violation.** A violation refers to a breach in Defence policy or SOPs involving EO.

3.8 Notifiable incidents. EO incidents that can be defined as notifiable incidents (NIs) must also be reported and managed in accordance with:

a. Defence Instruction (DI) Administrative Policy Annex C AG4 - Incident reporting and management (AG4).

b. Incident Reporting and Management Manual (IRMMAN[5]).

In cases where Work Health and Safety (WHS) issues are involved, incidents must also be reported and managed IAW:

a. Defence Safety Manual (*SafetyMan*).

b. Defence Casualty Manual (CASMAN) - when Defence members die or are seriously injured.

Investigating EO incidents

3.9 Background. Commanders and managers are responsible for assessing each EO incident they report, and determining the requirement for (and the degree of) further investigation.

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[4] Malfunctions do not include incidents resulting from negligence, malpractices or involvement in other situations, such as vehicle accidents or fires.

[5] IRMMAN provides the definition of a notifiable incident and detailed direction on managing such incidents.

3.10 Technical aspects. Groups and Services are responsible for the conduct of EO Incident management (including investigations). If the Unit does not have the capability to investigate the incident they need to liaise with the relevant Joint EO Support (JEOS) team or the Fleet EO Engineer in the first instance, to determine the level of technical support required (if any). Further assistance is available from agencies such as DOS, Defence Science and Technology (DST) Group, Capability and Sustainment Group (CASG), Joint Proof and Experimental Unit (JPEU) or lead capability managers[6].

3.11 The receipt of a report of an EO incident (by any means – e.g. via signal or phone call), shall be the authority for the Groups and Services to initiate technical fact finding activity in accordance with the Defence administrative inquiries process[7] or provide Subject Matter Expert (SME) advice in support of a related inquiry.

Responsibilities

3.12 Each element of Defence involved in the reporting, investigation, and administration of EO incidents is to ensure compliance with this regulation and the associated procedures.

3.13 Explosive Ordnance Branch (EOB). EOB supports the Director General Explosive Ordnance (DGEO) through the activities of its various directorates and units. EOB has the following responsibilities for Explosive Ordnance Incident Management System (EOIMS):

a. **Directorate of Ordnance Safety (DOS).** DOS is responsible for ensuring that EOIMS policy, process and procedures are in place and are effective and for the administration of the EOIMS System. This includes reviewing EOIMS from a whole-of-life-cycle, whole-of-Defence perspective, and reporting on EOIMS activities and safety trends to the Commander Joint Logistics (CJLOG), the Defence Explosive Ordnance Committee (DEOC) and senior Defence staff as required.

b. **Joint Proof and Experimental Unit (JPEU).** The JPEU conducts EO proof, test, evaluation and experimental activities in support of both Defence and external clients. JPEU may be requested to assist with EO incident technical investigations and/or provide SME advice in support of investigations

c. **EO Incident Administration Cell (EOIAC).** The EOIAC provides a central point of contact for the SENTINEL EO Event Stream and a support function to the Groups and Services (G&S) for the reporting of all EO incidents. The EOIAC, has the following responsibilities:

(1) SENTINEL EO Event Stream system administrator function to assist Groups and Services ensure integrity of the EO incident reporting process, event workflow and required data elements.

(2) SENTINAL EO Event Closer function that includes a QA role to ensure all elements of the event have been adequately captured and/or addressed.

(3) Provide advice and feedback on the status of incidents and investigations to senior management as required.

(4) Produce and disseminate reports and incident summaries to the DEOC, senior management and other stakeholders as required.

(5) Liaise with the Defence EO community to ensure compliance and awareness with EOIMS policy, process and procedures.

d. **Joint EO Support (JEOS).** JEOS provides EO technical support to the Australian Defence Force in order to enable operations and preparedness. This includes EO

[6] This is particularly important where the EO is suspect and/or safety is a concern; and/or restrictions in the EO's use in other areas of Defence may need to be considered

[7] Refer to the IRMMAN for additional guidance.

technical investigation, advice to EO users and commanders on EO management regulations and policy, and EO Disposal; with the aim to assure a safe and effective Joint EO enterprise. JEOS can be contacted regionally through 13 53 67 (13 JEOS).

3.14 Commandant Combined Arms Training Centre (COMDT CATC). The COMDT CATC is the Work Health and Safety (WHS) adviser for Australian Defence Force (ADF) small arms training and is responsible for the oversight of all WHS matters involving small arms weapon and range training. When any weapon, EO or range incident involving small arms occurs, COMDT CATC is to be forwarded copies of WHS incident reports, fact finding outcomes, administrative Inquiries, Service police investigations, EO technical reports or board of inquiry findings (subject to any security, privacy, confidentiality or disclosure constraints required by legislation, Defence policy or the ToR of and Inquiry or higher level investigation), by the quickest means possible to enable analysis of the incident. The Land Range Safety Branch (LRS) supports COMDT CATC's role as the WHS advisor for ADF small arms. The LRS is responsible for:

a. Analysis of data from the EOIAC and other sources to inform Defence in matters relating to small arms policy, doctrine, range safety, training and training support systems where EO is a component.

b. Providing accurate and timely advice to ensure that effective policy, doctrine, range safety procedures and training advice continues to support Defence.

3.15 Capability Managers (CMs). CMs must ensure that the Explosive Ordnance Incident Management System (EOIMS) requirements set out in this policy and related Groups and Services instructions and procedures are clearly and effectively promulgated across their respective commands. In the event that suspension of an EO nature is recommended, CMs hold final decision-making power and make decisions on the continued use of suspended EO after consideration of the hazards and risks associated with each activity.

3.16 Commanders and Managers. Commanders and managers must ensure that they understand and comply with Defence and Service-specific reporting requirements relating to EO incidents. They are to ensure that standing orders for EOIMS are consistent with the overarching EOIMS policy and process, including implementation of local emergency procedures, and their personnel are aware of, and compliant with, their responsibilities for reporting and handling EO incidents.

3.17 Officer in Charge (OIC) of the activity. The OIC at the scene or location of any EO incident is responsible for carrying out the following EOIMS responsibilities:

a. Reporting all EO incidents to their commander or manager in accordance with SOPs or Unit instructions.

b. Reporting all EO incidents in accordance with this regulation and associated procedures and other Defence policy.

c. Coordinating the EOIMS response activities for the local area on behalf of their CO, including immediate and emergency response procedures as required.

d. Liaising with other organisations and agencies, both internal and external, as required.

3.18 EO users. EO users are any Defence personnel and or contractors involved in the use or management of Defence EO, and who may therefore be involved in an EO incident. In the event of any EO incident, the EO users involved must ensure that:

a. All EO incidents are reported in accordance with this Regulation and other relevant Defence policy.

b. All information about an EO incident is recorded accurately and comprehensively, and any further information is added as soon as possible.

3.19 Capability Acquisition and Sustainment Group (CASG). The Explosive Materiel Branch (EMB) within Land Systems Division (LSD) of CASG manages the acquisition, in-service sustainment and disposal of all guided and non-guided EO for the Australian Defence Force (ADF).

3.20 Other agencies. A number of other Defence Groups and external agencies have responsibilities for EOIMS activities, particularly where EO incidents involve human casualty, criminal activity or require specialist skills and knowledge. These agencies include:

a. **Security and Vetting Service (S&VS).** The First Assistant Secretary Security and Vetting Service (FASS&VS) is the Chief Security Officer for Defence. The Chief Security Officer is responsible for developing and promulgating Defence security policy. They are also responsible for monitoring and reporting on compliance, performance and risks. The S&VS is the central point of contact for all Defence security incidents, including incidents involving weapons and EO. The principles and controls provided in the DSPF are to be followed for all EO security incidents.

b. **Defence Science and Technology (DST) Group.** DST Group provides science and technology research and development activities in support of Defence. DST Group may be requested to assist with EO incident investigations through the provision of specialist advice and services.

c. **Joint Military Police Unit (JMPU).** The JMPU provides incident investigation, evidence capture and forensic skills, especially in, but not limited to, instances in which criminal activity is suspected. They also provide guidance on the management of major, complex or sensitive incidents from initial notification through to closure, and support inquiries conducted by Defence, State Coroners or other civil agencies.

d. **Work Health & Safety (WHS) Branch.** The WHS Branch within Defence People Group (DPG) must be notified of all WHS incidents involving Defence personnel, contractors and visitors. Any EO incident which involves a fatality, injury, exposure to hazardous substances or a dangerous occurrence must be reported to WHS Branch in accordance with *SafetyMan* and the timeframes and instructions embedded within the Sentinel online reporting portal.

e. **COMCARE.** COMCARE is the national statutory authority responsible for ensuring and improving the occupational health and safety of Australian workplaces. COMCARE must be notified in the event of a death, serious personnel injury, incapacity or dangerous occurrence, and may become involved in EO incident investigations or conduct its own investigations in accordance with *SafetyMan*.

Procedures

3.21 Procedures used to implement the requirements of this regulation are:

a. Procedure 1 – Initial Response and Reporting Procedures

b. Procedure 2 – Incident Investigation – Technical Component

c. Procedure 3 – Post-Incident Management and Analysis

Annex

A. Related Policies, Instructions and Publications.

PROCEDURE 1 - INITIAL RESPONSE AND REPORTING PROCEDURES

Introduction

1.1 This document details the requirements for the initial response and reporting of all Explosive Ordnance (EO) incidents and is applicable to all Defence personnel and contractors. The timely and accurate reporting of EO incidents is essential for the effective investigation, management and analysis of EO incidents across Defence. The requirements have been designed to cater for worst case scenarios. Some elements may not be applicable to every situation and the Officer in Charge (OIC) of the relevant activity should exercise a commonsense approach when responding to an incident.

Immediate response/emergency procedures

1.2 In the event of an EO incident, appropriate immediate response/emergency procedures are to be implemented by the OIC of the activity. An immediate response/emergency procedure guide is provided at Annex A.

REPORTING EO INCIDENTS

1.3 All EO incidents[1] and incidents involving EO[2] that occur either within or outside Australia are to be reported in accordance with the relevant Defence policies and instructions and any external agency requirements. Key policies are listed in Annex A to Regulation 1.3. The following paragraphs describe EO incident categories and detail specific reporting requirements.

1.4 EO Incident Reporting System. For incidents involving EO, SENTINEL is the primary reporting tool. In situations or instances where access to SENTINEL via the DPN is not available for EO incident reporting, the web form EO016 can be used. However EO incident details reported in the EO016 must be transferred to SENTINEL at the earliest opportunity to ensure consistency in data and maintain a 'single source' of truth for governance reasons. The examples where the EO016 might be required include: platforms, such as submarines, do not have access to the DPN while at sea or deployed, field or range activities, or where information relating to equipment / activity is classified and is deemed not appropriate to be recorded in SENTINEL.

EO accident

1.5 **EO accident.** An accident is an unplanned, unintended, unexpected and/or undesired event, or series of events involving ammunition or EO, which results in:

a. Death, injury or occupational illness,

b. Substantial damage to the environment, or

c. Damage to equipment or property, regardless of ownership.

1.6 An EO accident (due to its broad definition) will have varying degrees of severity and consequence. Consequently, the reporting timelines and responsibilities will also vary for example:

a. EO accident resulting in fatality or serious personal injury:

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1 Where the event can be attributed to ammunition or EO in use such as an accident, potential hazard, malfunction or defect

2 An event that involves ammunition or EO, does not meet the classification as an EO incident, but is reportable due to security or procedural breeches.

(1) Commanders and Managers:

(a) Notify COMCARE immediately. Direction and guidance can be found the Defence Safety Manual (*SafetyMan*).

(b) Follow applicable direction and guidance provided by Defence policy documents listed at Annex A to Regulation 1.3.

(c) Notify the relevant Groups and Services within 2 hours and report the incident in SENTINEL within 6 hours.

(2) Groups and Services.

(a) Validate the submission with in SENTINEL within 2 hours of receipt.

(b) Directly provide or coordinate EO subject matter expertise support to any unit fact finding/investigation.

(3) EOIAC.

(a) Notify the Director General Explosive Ordnance (DGEO) through the Director, Ordnance Safety (DOS) as soon as possible.

b. EO accident resulting in exposure, minor injury or damage to equipment or property:

(1) Commanders and managers:

(a) Action SENTINEL report within 24 hours.

(b) Follow applicable direction and guidance provided by Defence policy documents listed at Annex A to Regulation 1.3.

(2) Groups and Services

(a) Validate and submit the Unit's SENTINEL report within 48 hours of receipt.

(b) Directly provide or coordinate EO subject matter expertise support to unit fact finding/investigations.

(3) EOIAC:

(a) Notify the Director General Explosive Ordnance (DGEO) through the Director Ordnance Safety (DOS) as soon as possible.

EO near miss, EO malfunction and EO defect

1.7 Definitions of an EO near miss, malfunction, defect or violations are described in Regulation 1.3 and examples are shown in Annex B. Reporting requirements for such incidents are:

a. Commanders and managers:

(1) Submit a SENTINEL report within 7 days.

b. Groups and Services:

(1) Validate the submitted Unit's SENTINEL report within 48 hours of receipt.

c. EOIAC

(1) Notify the Director General Explosive Ordnance (DGEO) through the Director, Ordnance Safety (D,OS) as soon as possible.

Notes:

EO incidents can also be initially reported via phone and followed up with a SENTINEL report.

SENTINEL report requires validation by Groups and Services and is to include: confirmation of incident type, the allocation of a causation code (refer Annex C) to provide an initial assessment as to the root cause of the incident and verification of the reported EO configuration and serviceability.

1.8 Commanders and managers may, if deemed appropriate and based on an operational risk and technical advice, immediately suspend the use of a particular EO nature within their Unit following an EO incident. Wider suspension across the national support base will be managed through formal advice from the relevant Capability Manager (CM) and/or CASG as necessary.

Reporting notifiable incidents

1.9 Some EO incidents may also be defined as Notifiable Incidents (NIs). In addition to the reporting requirements detailed in this procedure, all NIs are to be reported in accordance with the Incident Reporting and Management Manual (IRMM) or *SafetyMan*.

Fact finding and EO subject matter expertise input

1.10 EO incidents should be managed in accordance with Defence incident management policy. The relevant JEOS team can provide advice or support regarding the technical component of the process.

Other reporting requirements

1.11 Incidents involving EO that may be reportable due to security breaches are to be reported in accordance with extant policy.

Annexes:

A. Immediate response/emergency procedures guide for the officer in charge
B. Abridged explosive ordnance incident definitions with examples
C. Causation codes

ANNEX A

IMMEDIATE RESPONSE/EMERGENCY PROCEDURES GUIDE FOR THE OFFICER IN CHARGE

The following list of actions is a suggested guide and commonsense should be applied to suit the incident. The Defence Incident Scene Initial Action and Preservation Manual (DISIAPM) provides further direction and guidance on incident scene management.

This Annex can be reproduced and kept with range/exercise packs or at range control.

Action List

1. Order a cease-fire, if applicable.

2. Prevent the use and movement of all remaining Explosive Ordnance (EO) of the same lot/batch.

3. Make the incident site safe for emergency personnel. This includes turning off electrical and transmitting equipment in the immediate area until it can be confirmed that there are no electrically initiated explosive devices in the vicinity.

4. Administer first aid and evacuate any casualties.

5. Inform the range control officer/OIC exercise, and request that the incident be reported to the Groups and Services. Request the attendance of a suitably qualified and authorised EO technician or engineering officer, if necessary.

6. Inform the Commanding Officer of your unit and any other units involved.

7. Inform the Civil and/or Service police if there have been deaths or injuries.

8. Seal off the area to ensure that evidence is not destroyed, damaged, lost or moved. Access must be strictly limited to authorised personnel only, and nothing should be moved or cleaned, including bodies, weapons, fragments and unfired/unused EO.

9. Arrange for the site to be appropriately guarded.

10. Establish an Incident Control Point (ICP) close to the site and stay there until relieved.

11. Move personnel to a Rendezvous Point (RVP) a short distance away, where they can be easily contacted, but where they are out of the way of the incident site and any emergency or investigating personnel. Keep everyone here unless and until they are physically required at the site or at the ICP.

12. Inform emergency personnel, higher command, range/exercise control and JEOS (as required) of the location of your RVP and the safest access route(s).

13. Identify witnesses and ensure they are kept separated and do not communicate with other witnesses or unauthorised personnel.

14. Record:

    a. Witnesses' names and contact details

    b. A log of events and actions taken, including:

        (1) Time of incident and when emergency services, range control, etc. were informed

        (2) Weather conditions - temperature, humidity, rain, etc.

(3) Storage conditions of the EO involved – e.g. exposed to sun, rain, under cover, etc.

(4) Number of rounds or missiles fired prior to the incident

(5) Possibility of obstruction – e.g. natural (trees, etc.) or artificial (muzzle cover, etc.)

(6) Rate of fire

(7) Quadrant elevation and charge setting

(8) Any abnormalities

(9) Distance of incident from muzzle or launcher

(10) Fuze setting and checking

(11) Location of personnel before and after event

(12) A description of events leading up to, and following, the event with comment of any unusual occurrences - e.g. description of smoke cloud, unusual sound of discharge or burst

(13) Details of the EO involved (if you are not EO-trained, copy any information provided on the item or its container/packaging)

(14) Any possible sources of electro-magnetic radiation - e.g. aircraft, radars, radio transmitters

(15) Any other relevant information.

15. Have witnesses record their own version of events.

16. Make a map of the incident area.

17. Take photographs of the incident, if possible.

18. If there are any fatalities, the WH&S Branch of Defence People Group and COMCARE are to be informed by telephone immediately. The Defence Safety Manual (*SafetyMan*) provides further direction and guidance on this subject.

19. Prepare an initial report in accordance with the requirements of this regulation.

Other Guidance

Annex A to Regulation 1.3 provides a list of key Defence policy concerning the management of incidents within Defence. All EO incidents are to be managed in accordance with these policies.

Key Points to Note

1. Remain neutral and do not allow yourself to be swayed by those who maywish to conceal something or influence the investigation.

2. Remember that you could face criminal or disciplinary action if you hinder the investigation.

3. Do not get involved in trivial tasks – delegate where possible, but limit the number of people who have access to the incident site and/or evidence.

4. Limit the number of people in your ICP to those essential for the immediate response.

5. If witnesses talk to each other, their view of what happened becomes clouded and

their evidence is less reliable. Minimise witness contact as soon as possible after the event.

6. Collect witnesses' details separately from their statements.

7. Do not release the names of dead or injured to anyone not authorised to know.

8. Do not speak to the media; refer them to your higher command organisation.

9. Establish your ICP and RVP where they can be easily found and accessed, such as on an obvious route into the incident site and before your ICP. Place your ICP in a position where the incident site can be seen, if safe to do so.

10. Do not give out the location of your ICP. Control access to it through the RVP, otherwise people will bypass the RVP and proceed straight to the ICP.

11. Place a strong character in charge of the RVP, who will be robust enough to prevent senior, but unauthorised, personnel from accessing the incident site and/or your ICP.

12. Arrange for meals to be sent out to you, as you may be there for some time if the incident is serious.

13. Do not neglect your own needs for drink, food and sleep.

14. If evidence has to be moved:

    1. Keep those handling it to a minimum

    2. Make sure that it is always signed for and properly tracked

    3. Do not allow it to be left unattended

    4. Record the details of all individuals who have been in contact with it, as well as why and when

    5. Do not allow any changes to be made to it. If changes are made, deliberately or inadvertently, record by whom, when, what was done and why.

ANNEX B

ABRIDGED EXPLOSIVE ORDNANCE INCIDENT DEFINITIONS WITH EXAMPLES

1. The following list comprises examples of common Explosive Ordnance (EO) incidents that may result in the generation of a SENTINEL report in accordance with this procedure.

2. **EO accident**. An accident is an unplanned, unintended, unexpected and/or undesired event, or series of events involving ammunition or EO, which results in death, injury or occupational illness, substantial damage to the environment, or damage to equipment or property, regardless of ownership. Examples of an EO accident include:

    a. A grenade is dropped in a throwing bay and the thrower receives a fragmentation wound.

    b. Whilst loading a vehicle with a pallet of small arms ammunition, the forklift operator inadvertently pierces an ammunition container with the forklift.

    c. Whilst setting a trip flare, it functions prematurely due to an incorrect procedure and the layer is burnt.

    d. A firer receives a gunshot wound.

3. **EO near miss**. An EO near miss is an event where no person is injured or property significantly damaged, but the event is worth analysing as any repeat occurrences may result in an accident, or the event may indicate a wider problem requiring investigation and possible remedial action to mitigate the potential of another event occurring. Examples of an EO near miss include:

    a. EO is stored in an unlicensed site.

    b. Whilst un-banding a pallet of ammunition the banding strap is not released under control and nearly strikes a bystander.

    c. An unauthorised small arms discharge where the fall of shot impacts outside the safety template.

4. **EO malfunction**. A malfunction is a failure in an item of EO to function as expected when fired, launched, or otherwise activated, or when explosive components function during a non-functioning test[1]. Malfunctions include abnormal or premature functioning of an item of EO as a result of normal use, handling, maintenance, storage and transport that does not result in an EO accident. Examples of an EO malfunction include:

    a. HE mortar bomb fails to detonate on impact

    b. Marker marine fails to function when deployed

    c. Detonator misfires during a demolition practice

    d. Smoke grenade fails to function when thrown.

5. **EO defect**. A defect is any fault in the make up or marking that may cause a failure in the performance or any deterioration or damage to the physical state of the EO or its container. The defect category can also include circumstances where EO is no longer deemed fit for purpose and fails to meet the user's needs. Examples of EO defects include:

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[1] Malfunctions do not include incidents resulting from negligence, malpractices or involvement in other situations, such as vehicle accidents or fires.

a. An ammunition container is not marked in accordance with the regulations

b. A projectile is missing required weight zone markings

c. Plastic explosive is not sufficiently malleable

d. A tank projectile will not chamber in the gun.

6. **EO violation.** A violation refers to a breach in Defence policy or SOPs involving EO. Example of EO violations include:

a. A container marked Free From Explosives (FFE) but containing munitions that have not certified as being FFE.

b. An item not correctly certified in accordance with the DEOCL Database.

c. A breach of Explosive Limit Licence (ELL) restrictions.

d. EO is stored in an unlicensed site.

ANNEX C

CAUSAL CODES

Causal Code	Sub Code & Description	Detailed Description
Ammunition at Fault A	Functional/Performance Failure – Within Limits A1	Failure of the ammunition has been investigated by the responsible engineering authority (EMB) to ensure it is within its accepted failure rates for a known mode of failure (e.g. misfire, blind etc.).
	Ammunition Design A2	Inherent fault with the ammunition design or design requirements (either through engineering activity/trial or user feedback that item is not meeting capability requirements).
	Ammunition Manufacture / Production A3	Failure resulting from unapproved deviation of design or use of faulty components during manufacture / production (e.g. components missing in primer, safe and arm assembled incorrectly).
	Ammunition Maintenance A4	Failure resulting from unapproved deviation of maintenance procedure or failure to conduct maintenance, including incorrect package marking.
	Deterioration of Ammunition – Physical/MTDS A5	Physical state of the ammunition has deteriorated due to the storage or operational environment (within design limits) e.g. corrosion on ammunition, moisture ingress into black powder, excessive handling.
	Outside of Design Parameters A6	Ammunition has been utilised or stored outside of its design limits which has resulted in an accident occurring. (E.g. para-dropped, used in incorrect weapon, fired underwater, out of service life etc.)
	Deterioration of Ammunition - Performance A7	Item still generally operates as designed however not in accordance with the functional design requirements (early burst, low volume smoke production etc.) due to its storage or operational environment (within design limits).
	Ammunition suspected – Cause Indeterminable A8	Incident has been investigated and cause is unable to be specifically determined however it is believed that on the balance of probabilities the ammunition is at fault.

ANNEX C

Causal Code	Sub Code & Description	Detailed Description
Ammunition not at Fault N	Error of Drill (Human error) N1	User failed to follow promulgated SOPs or training which lead to the incident – User at fault. (e.g. unauthorised discharge, failure to set fuze correctly, failed to arm munition, failure to remove safety pins, storage security breach etc.).
	Error in Drill (Process error) N2	User followed promulgated SOPs or training however SOPs/training found to be deficient or inadequate and lead to the cause of the incident.
	Equipment/Weapon Failure N3	Equipment or weapons system failed which caused failure or damage to ammunition. Whilst the ammunition may or may not have contributed to the severity of the incident, the primary cause of the incident was due to the equipment or weapon failure when being used as designed. (firing pin failure, crane cable breaks etc.). If not being used as designed then primary cause was N1 or N2. Requires reference to RODUM or URDEF.
	Transport N4	Incident or occurrence that was attributable to the mode of transport (e.g. rattle and roll deterioration, motor vehicle accident).
	Handling/Storage N5	Incident or occurrence that was attributable to the storage and transport environment (failure of A/C, exposure to elements causing rusting of packaging etc.) or rough or mishandling.
	Tampering N6	Incident or occurrence was a result of tampering (generally involves malicious intent)
	Range Construction/ Maintenance N7	Incident or occurrence that was attributable to inadequacies in range construction, such as insufficient bunker heights or deterioration through lack of maintenance.
	Ammunition not suspected - Cause Indeterminable N8	Incident has been investigated and cause is unable to be specifically determined however it is believed that on the balance of probabilities the ammunition is not at fault.
Cancelled C	Cancelled C0	For administrative use only – report raised in error, duplication etc.

PROCEDURE 2 - EXPLOSIVE ORDNANCE TECHNICAL INVESTIGATIONS

Introduction

2.1 Explosive Ordnance (EO)[1] when handled incorrectly or by manufacturing defect may become unsafe and result in an incident. Swift inquiry/investigation of all EO incidents is needed to ensure the risk of further incidents is reduced so far as reasonably practicable. This is particularly important in situations where human safety is a concern. Care should be taken to ensure that EO technical investigations are conducted with proper preparation and sufficient resources to effectively carry out the task. The selection of skilled and appropriately qualified personnel is critical to the expedient and effective conduct of these investigations.

2.2 Incidents involving EO that do not meet the threshold for the instigation of an Inquiry[2] or higher level investigation (e.g. inquiries conducted by the Inspector-General Australian Defence Force, or an investigation under the *Defence Force Discipline Act 1982*) must still be examined and the findings reported via an entry into the SENTINEL EO Event stream. The technical aspects of such investigations may be informed by the guidance provided below.

Inquiries or investigations related to EO incidents

2.3 Any Inquiry or investigation involving an EO incident must consider both administrative and technical factors which may have contributed to the event. All Defence personnel and contractors with a responsibility for the Inquiry or investigation into an EO incident are to ensure they are conducted in accordance with Terms of Reference (ToR) for the Inquiry or investigation and relevant Defence policy e.g.:

a. Defence Instruction (DI) Administrative Policy Annex C AG4 - Incident reporting and management (AG4)

b. Incident Reporting and Management Manual (IRMMAN)

c. Administrative Inquiries Manual (AIM)

d. Defence Safety Manual (SafetyMan)).

2.4 A list of key Defence policies is provided in Annex A to Regulation 1.3. Where guidance provided in this procedure conflicts with a Defence policy referenced in Annex A to Regulation 1.3, the relevant Defence policy is to take precedence.

2.5 EO technical investigations are to be carried out as soon as possible after the incident has occurred, and the findings reported to the authority initiating the technical investigation. The report will assist the initiating authority's decision regarding the extent and level of further investigation (e.g. an Inquiry Officer's Inquiry, Board of Inquiry etc.) required.

Selection of EO technical investigators and teams

2.6 On receipt of an EO incident report (whether by receipt of a SENTINEL Report, verbal report or otherwise), Groups and Services (G&S) are to provide subject matter expert advice and fact finding support to the reporting unit if required.

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[1] In addition to the NATO EO definition found in the glossary of terms, and in the context of EO incident reporting, this also pertains to all similar and related EO items and components that are non-explosive (inert) in nature (including containers and packaging).

[2] For example a road traffic accident involving a vehicle transporting EO, where the EO itself was not the cause or contributing factor to the accident.

2.7 G&S's must ensure that a suitably qualified person is assigned to the task. The EO technical investigator is to possess sufficient technical knowledge and experience to be able to examine the incident and evidence at hand, form impartial opinions and draw defensible conclusions as to its cause. They should be familiar with the direction and guidance on fact finding provided in *Good Decision-Making in Defence: A guide for decision-makers and those who brief them* and the requirements of relevant Defence policy documents listed in Regulation 1.3 Annex A.

2.8 If a suitable subject matter expert is not available to the G&S's and JEOS is unable to assist, then the Director, Ordnance Safety (D,OS) within the Explosive Ordnance Branch (Joint Capabilities Group) is to be notified with a request for assistance to identify and appoint a suitable person.

2.9 An EO technical investigator must be free from any actual, or suggested bias or conflict of interest involving the incident in question and must not be assigned to investigate an incident in which they have been directly or indirectly involved. Any potential biases, conflicts of interest or involvement must be disclosed immediately to the initiating authority.

2.10 Sufficient personnel, administrative and financial resources are to be allocated for the proper conduct of any EO technical investigation. The EO technical investigator must promptly seek additional assistance should it become obvious that the allocated resources are inadequate for the investigation to be completed as tasked.

Scoping and planning the EO technical investigation

2.11 Scoping involves developing an appreciation of the nature, dimensions and implications of the EO technical investigation. Adequate planning of the EO technical investigation facilitates efficient information gathering and ensures the EO technical investigation is correctly focused. Scoping may be undertaken by the EO technical investigator prior to commencing the investigation. It must be noted however, that an EO technical investigation is not a replacement for an administrative Inquiry or other formal investigation, nor is it to interfere or compromise such processes. The scope of the technical investigation therefore, is to be restricted to technical aspects contributing to the EO incident.

2.12 If the EO technical investigator anticipates that the investigation will be reasonably straightforward, the requirement to scope a technical investigation may not be required. However, the development of a full EO technical investigation plan may be required if it becomes clear that the seriousness of the incident could lead to an Inquiry or higher level investigation. The detailed guidance for scoping and planning an Inquiry provided in the AIM can also be used to scope and plan an EO technical investigation.

Records management and file creation

2.13 All information, documents, statements and actions taken by EO technical investigators are to be recorded in accordance with the Defence Records Management Policy Manual (RECMAN). When the investigation is in support of an administrative Inquiry or higher level investigation, it is essential that the EO technical investigator complies with all recordkeeping and disclosure caveats in the relevant ToR and relevant Defence policy.

2.14 It must be noted that unauthorised disclosure of records of an Inquiry is an offence under *Defence (Inquiry) Regulations 1985*. Guidance on the dissemination of information (in whole or part) derived from EO technical investigations should be sought from the Inquiry Officer (IO) leading the Inquiry in the first instance. The AIM provides further policy direction on this issue.

Conducting the EO technical investigation

2.15 The purpose of the EO technical investigation is to examine the <u>technical</u> aspects of incidents involving EO i.e. identifying actual or potential technical cause(s) in order to recommend action for remediation and to reduce the risk of further incidents occurring.

2.16 The investigative response will be based on an initial assessment of the incident and the likelihood of further incidents. In the first instance, the information available to the EO technical investigator may be limited. Initial assessments are to be refined as more information becomes available and should be aimed at providing justification for or against further investigative action, as well as suggestions for what type of action might be required.

2.17 EO technical investigations that do not form part of an administrative Inquiry or higher level investigation are to be guided by the *Good Decision-Making in Defence: A guide for decision makers and those who brief them* and where appropriate, the Defence Incident Scene Initial Action and Preservation Manual (DISIAPM). Where an EO technical investigation becomes part of an administrative Inquiry (e.g. where the IO requires Subject Matter Expert (SME) support), the investigation is to be guided by the ToR for the Inquiry and the AIM.

2.18 In some instances, criminal or disciplinary investigations (under the *Defence Force Discipline Act 1982*) or an administrative Inquiry may be instigated while an EO technical investigation is in progress. If it becomes clear that the EO technical investigation may impede or needs to be brought under the ToR of a broader investigation or Inquiry, the EO technical investigator must inform the initiating authority immediately. The broader Inquiry or investigation is not to be hampered or compromised in any way.

EO technical investigation report

2.19 As noted above, EO technical investigations are to be carried out as soon as possible after the incident has occurred. Simple incidents may permit rapid review and completion, while others may prove complex and take longer to complete (e.g. incidents occurring offshore where no technical staff are located, and/or cases in which access to the incident site is not available). In such cases, EO technical investigators must ensure that the initiating authority is advised of any delays or potential for delay, as well as any revisions to estimated timeframes. The initiating authority is to advise their G&S's as soon as possible and request additional support if required.

2.20 Unless there is a specific requirement demanded by the ToR of an Inquiry or higher level investigation, the format of a EO technical report is to follow the general format of a Defence report (refer to the Defence Writing Manual for further guidance) with EO incident-specific modifications. The final report of an EO technical investigation must present simple, clear statements about the incident that a non-technical person can understand. Statements made in reports must be justifiable, objective and defensible.

2.21 Any peer reviews of EO technical investigation reports are to be subject to any security, privacy, confidentiality or disclosure constraints required by legislation, Defence policy or the ToR of and Inquiry or higher level investigation.

Submission and dissemination of EO technical investigation reports

2.22 Submission of reports not part of an Inquiry or higher level investigation. If an EO technical investigation does not form part of an Inquiry or higher level investigation, the EO technical investigator is to provide a copy of the completed EO technical investigation report to the authority initiating the investigation.

2.23 Subject to any security, privacy, confidentiality or disclosure caveats that may be applicable, the authority initiating the EO technical investigation is to ensure relevant sections of the report are entered into the Sentinel EO module[3].

2.24 Submission of reports forming part of an Inquiry or higher level investigation. In most cases, an EO technical investigation will precede an Inquiry or higher level investigation and therefore submission and dissemination of the technical investigation report will not be constrained by the Inquiry or higher level investigation. However, where an EO technical investigation is initiated during the course of an administrative Inquiry or higher level investigation (e.g. in cases where the IO requires SME support), the EO technical investigator is to submit the report in accordance with the ToR of the Inquiry or higher level investigation. In this situation, wider dissemination of all or part of the

[3] This may include attaching the full report to the SENTINEL entry if security caveats allow.

report will be subject to the ToR of the Inquiry or higher level investigation, relevant Defence policy and applicable legislation.

EO incident remediation and monitoring

2.25 Specific areas within Defence will be responsible for addressing and/or remediation recommendations. The G&S's will monitor their respective EO incidents until all remedial actions are complete or have been adequately addressed. Agencies responsible for remedial activities should report on their progress and completion to the respective G&S as appropriate. G&S's will identify and report on vulnerabilities, risks and issues arising out of EO incidents at the EO Incident Reporting and Management Committee (EOIRMC) meeting chaired by the DOS.

PROCEDURE 3 - POST-INCIDENT MANAGEMENT AND ANALYSIS

Introduction

3.1 The purpose of post-incident management is to ensure the proper closure of Explosive Ordnance (EO) incidents and that information and improvements stemming from such closures are communicated and enacted for the benefit of the Defence community. These aims are achieved through ongoing monitoring, analysis, reporting and distribution of the status of EO incidents to relevant organisations within Defence.

3.2 Regular analysis of EO Incident data can assist in the identification of systemic issues within Defence's management of EO incidents, and contribute to the ongoing improvement of the EO Incident Management System (EOIMS) as a whole. Ultimately, this will encourage a higher level of awareness and compliance throughout Defence, and reduce the number and severity of EO incidents.

Closure of EO incidents

3.3 All reported EO incidents will be held in SENTINEL that is maintained by the Explosive Ordnance Incidents Administration Cell (EOIAC). Service and Groups are responsible for their EO Incidents management, including closure. The initiating unit and/or management hierarchy will be advised of any outcomes and causes of the incident and any recommendations arising from the investigation.

Data integrity in SENTINEL

3.4 The EOIAC will monitor EO incidents recording in SENTINEL as part of its ongoing responsibilities. This includes checking that data is accurate, current and relevant, and that actions arising from any investigations into EO incidents are not left open indefinitely. Where data is incomplete, conflicting, superseded or otherwise erroneous, the EOIAC will communicate with, and seek input from, relevant stakeholders as necessary. Groups and Services should conduct periodic assurance activities of EO incident data held in SENTINEL as part of their self-assessment systems. Tier 4 EO assurance activities will also be conducted on the management of EO incidents in SENTINEL as part of the EO Assurance Framework. This information will be fed into reports for stakeholders.

Production of summary reports

3.5 Individual Groups and Services are responsible for their own EO incident summary/status reports as part of Defence Enterprise reporting to committees as required. These reports can be generated within Safety Trend Analysis Reporting Solution (STARS).

Reporting results of analysis

3.6 Groups and Services are to provide analysis reports on their EO incidents on a quarterly basis to the Explosive Ordnance Safety Assurance Board and biannually to the Defence Explosive Ordnance Committee as part of their EO self-assessment system.

ANNEX A

RELATED POLICIES, INSTRUCTIONS AND PUBLICATIONS

Defence Instruction Administrative Policy

DEFLOGMAN Part 2, Volume 9 - Defence Explosive Ordnance

Defence Explosive Ordnance Program (DEOP) 100 Volume 2 - Defence Explosives Safety Regulatory Framework

Good Decision-Making in Defence: A guide for decision-makers and those who brief them

Defence Incident Scene Initial Action and Preservation Manual (DISIAPM)

Incident Reporting and Management Manual (IRMMAN)

Administrative Inquiries Manual (AIM)

Defence Security Principles Framework (DSPF)

Defence Safety Manual (*SafetyMan*)

Defence Casualty Manual (CASMAN)

Records Management Policy Manual *(RECMAN)*

REGULATION 1.4 - AUDIT AND MONITORING ACTIVITIES FOR EXPLOSIVE ORDNANCE FACILITIES

WITHDRAWN

4.1 Regulation 1.4 has been withdrawn in preparation for the release of the Explosive Ordnance Assurance Framework policy. Supporting documentation has been published in DEOP 100. For further information regarding the Explosive Ordnance Assurance Framework contact Mr Philip Lingard at the Directorate of Explosive Ordnance Governance.

WITHDRAWN

REGULATION 1.5 - INSPECTION OF EXPLOSIVE ORDNANCE

Introduction

5.1 Explosive Ordnance (EO), which for the purposes of this regulation includes associated non-explosive accessories and packaging, form a class of stores which are inherently hazardous and therefore require precautions to be taken and procedures to be followed for safe storage, transport, handling and operation. These precautions and procedures are essential to ensure safety of personnel and property, preserve the serviceability of EO, indicated throughout this regulation as 'inspection', which is normally conducted as part of an authorised surveillance plan.

Aim

5.2 This regulation promulgates policy for the inspection of EO and provides direction to personnel undertaking inspection activities.

Scope

5.3 This regulation details the policy and procedures for the inspection of EO.

5.4 This regulation does not give user inspection criteria and inspection processes. That information is found in the relevant item publication for the nature being inspected.

Relationship to Surveillance

5.5 Surveillance is the activity or series of activities established to determine whether EO, once introduced in to ADF service remains safe to store and transport, safe to operate, and will perform within acceptable performance limits. Inspection is one of those activities. Other surveillance activities may include destructive testing, functional testing or in-service firing reports.

Authorisation of Inspectors

5.6 **Assessment of EO Inspectors.** The inspection of EO is to be conducted by personnel assessed as competent and authorised to conduct such inspections. Part of the assessment competency includes demonstrated knowledge by the inspector of the Configuration Item (CI) being inspected, their method(s) of functioning, operational limitations, current modifications status and storage requirements.

5.7 **Authorisation of EO Inspectors.** Organisations specified in paragraphs 5.12 – 5.13 are responsible for authorising all EO Inspectors in their particular organisations. The written authorisation is to contain, as a minimum:

a. Personal details of the EO Inspector;

b. The organisation to which the inspector belongs;

c. The scope of EO for which the authorisation is applicable;

d. Details of the EO inspectors Identification Code;

e. Duration of the authorisation; and

f. Any applicable caveats relating to the granting of the authorisation.

Facilities where Inspections are conducted

5.8 EO Inspections relating to maintenance must only occur within a facility that is suitably licensed for such activities. Inspections for the purpose of verifying the content of a package, such as inspecting the contents of a fraction pack, may be conducted outside the licensed facility provided the access door to the facility is closed.

Inspection Criteria

5.9 The inspection process, acceptance and rejection criteria are promulgated in the individual item's publication. Should the inspection criteria not be published, EO Inspectors are to contact the sustainment manager in the Explosive Materiel Branch (EMB) within the Capability, Acquisition and Sustainment Group (CASG) for further direction.

5.10 No inspection or processing of EO is to be undertaken unless the details of the procedure for each operation, and appropriate tools required to complete the task, are appropriately authorised in written instructions. Those instructions, including associated safety details and any other data that may be required, are to be available at the work site.

5.11 The instructions and safety data are to be referred to by the EO Inspectors and Supervisors to ensure safety during the inspection activities.

Responsibilities

5.12 Responsibilities for the inspection of EO are primarily allocated to appointments within Joint Logistics Command (JLC), the authorised EO Storage Provider, authorised single Service elements and deployed ADF personnel. These responsibilities include:

a. Authorising personnel to conduct inspection activities in authorised locations;

b. Undertaking inspection activities; and

c. Compliance checking of inspection activities.

5.13 CASG is responsible for the preparation and approval of inspection standards against which all inspections are to be conducted and the frequency of those inspections.

Procedures

5.14 Procedures used to implement these regulations are:

a. Procedure 1 – Inspection and Associated Documentation

b. Procedure 2 – Work-marking Explosive Ordnance, Associated Components and Packaging

c. Procedure 3 - Defects Classification and Sentencing

PROCEDURE 1 - INSPECTION AND ASSOCIATED DOCUMENTATION

Introduction

1.1 The accurate and detailed recording and reporting of the results of an inspection program is integral to the efficient conduct and success of any such program. The movement of Explosive Ordnance (EO) and associated non-explosive equipment for inspection, recording the inspection results and subsequent processes, must be strictly controlled and documented.

Aim

1.2 The aim of this procedure is to identify and describe the requirements for the inspection of EO.

COMSARM

1.3 Computer System Armaments (COMSARM) is an IT system specifically designed for the Department of Defence EO Management. The system is used by the Explosive Materiel Branch (EMB) within the Capability Acquisition and Sustainment Group (CASG), the Explosive Ordnance Branch (EOB), associated EO Service Providers and single Service units for the management of the EO inventory.

INSPECTION

Inspection Types

1.4 There are seven types of inspection. An overview of each inspection type is given in paragraphs 1.5 – 1.12. Inspected EO is to be sentenced in accordance with the requirements of Procedure 3. Where the lot identification of a quantity of EO cannot be established the actions promulgated in Annex A are to be taken for stock management purposes.

1.5 **Receipt Inspection.** Items are to be visually inspected on receipt from the manufacturer. A limited quantity is to be confirmatory inspected irrespective of the level of confidence in the manufacturer's quality assurance. The required inspection is for latent defects, not to identify age-related degradation of the item. The requirements and the quantity to be inspected are to be included in the surveillance plan.

1.6 **Routine Inspection.** Routine Inspections are conducted at predetermined periods during the Service Life of EO. A Routine Inspection monitors the visual condition of EO to detect any deterioration that may have occurred.

1.7 **Pre-Issue to User Inspections.** There is no requirement to inspect EO in factory-sealed, original outer packaging, prior to issue, unless the need is registered on COMSARM. Unsealed packages should be inspected to determine a confidence level in the condition of the contents. The sustainment manager is to determine the extent of the inspection, based on the item's history and storage conditions.

1.8 **Return from User (broken seal) Inspection.** Return from User (broken seal) Inspections are carried out on EO returned by users and are designed to assure the technical integrity of EO for continued storage and transportation. The following inspection requirements apply to EO returned from user units:

a. 100% of all EO loaded to naval vessels, other than that transported in naval vessels in original packaging, of which a percentage should be checked to ensure that the seals are correct and intact;

b. 100% of all EO return from land based units (including Air Force and Navy units) where any of the following conditions apply:

(1) The EO has been outside Australia;

(2) The authorised seal has been broken; or

(3) The EO is life expired.

c. There is no automatic requirement to inspect other returned EO, as it should have been in an environment against which its design has already been assessed. However, it may have experienced the extremes of this environment whilst in unit hands, and may be the fleet leader in terms of age related degradation. The sustainment manager should consider updating the surveillance plan to reflect this and the need to conduct inspection at the next surveillance interval.

1.9 **Proof.** EO for Proof is to be 100% inspected prior to issue to the proof agency.

1.10 **Special Inspection.** Special Inspections are undertaken at the request of the stockholder or EMB to establish the condition of a specific item. For example, special inspections are required:

a. When ordered by EMB to investigate a suspected defect in functioning, design, manufacture or to check for incorporation of modifications;

b. When, as a result of a previous inspection, further investigation is required;

c. When considered necessary by the stockholder, for example to identify or confirm quantities or the condition of stock;

d. When deemed necessary by an EO Inspector based on the results of a current inspection; or

e. When required by EMB in support of investigations (for stock not held in an EO depot, such as stock held in a unit magazine which was inspected by Joint Logistics Unit's EO Services staff).

1.11 Detailed instructions for these inspections are to accompany the direction provided for inspection, including quantities to be inspected and sentencing criteria.

1.12 **User Level Inspection.** All users are to inspect EO before use. In some cases, users may not have the detailed technical knowledge/experience, or the item publications necessary, to detect technical problems. However, commanders are to ensure that all are competent to handle the EO that they are required to use. There are many aspects of competency that should be assessed before an individual is deemed capable of using the EO safely. The minimum level must ensure that the individual can recognise whether any of the following deviate from what would be expected from a fully serviceable and safe item:

a. Shape;

b. Size;

c. Colour;

d. Markings;

e. Surface condition (bulges, cracks, scratches, dents, etc)

f. Corrosion; and

g. Integrity (parts broken or missing; components loose, etc).

NOTE

Whilst an inspection cannot categorically determine that the item is serviceable, the resulting assessment of 'serviceable', is in fact, stating that the item is unlikely to be unserviceable.

Inspection Sampling

1.13 The identification and selection of samples of EO for inspections is to be conducted in accordance with DEOP 112 *Statistics for Explosive Ordnance Engineering* unless directed otherwise by EMB.

Inspection of Explosive Ordnance

1.14 **Packaged Explosive Ordnance.** The inspection sequence of actions to be carried out by inspection staff, following selection of the sample to be inspected, is as follows:

a. The outer package is to be examined to verify that:

(1) The authenticity seals are serviceable and correctly applied;

(2) The identification details agree with those shown on the documentation used to initiate the inspection and conform to the requirements of Regulation 2.3 Procedure 4;

(3) The condition of the package is representative and standard for the batch/lot; and

(4) The condition of the package is adequate to withstand handling, storage and transportation expected for such a store.

b. The inner package, where applicable, is to be examined to verify that:

(1) The identification details agree with those shown on the outer package;

(2) The condition of the package is representative and standard for the batch/lot; and

(3) The condition of the package is adequate to withstand handling, storage and transportation expected for such a store moved in its approved outer container.

c. The EO is to be examined to verify that:

(1) The identification details agree with those shown on the outer package;

(2) The EO has not been restricted;

(3) The EO is within the Service Life specified in Topic -024 of the item publication;

(4) Safety devices are secure and indicate safe, eg safety windows;

(5) Appropriate warning labels are attached securely and are in good condition;

(6) There is no evidence of deterioration, improper assembly, missing components, unsafe conditions, or damage when assessed against the inspection criteria of the item inspection procedure; and

(7) Where appropriate, there is evidence that modifications have been incorporated.

d. Where stores are found to be other than serviceable, inspectors are to assess the reasons for the unserviceably and determine the affect or likely affect, on:

(1) Safety for storage and transport,

(2) Operational functioning, and

(3) Performance.

Inspection of Explosive Ordnance Fitted to Defence Air, Land and Sea Vehicles

1.15 It is often impractical and, in many cases, operationally unacceptable to physically inspect EO fitted to, or held in, aircraft, armoured vehicles or watercraft, issued to aircrew, or packed in safety and survival equipment. The procedure for undertaking this activity is given in Annex B.

Inspection of Restricted Explosive Ordnance

1.16 EO that is Restricted is to be inspected using the standard inspection criteria. Stock found to be serviceable, except for the reason for which it was Restricted, is to be reconfirmed in the existing sentence and the conditions of the restriction are to remain in force. If the EO is found to be unserviceable for reasons other than those that caused the restriction action, the EO is to be sentenced accordingly and the Form EO 100 suitably annotated. Cross reference to Explosive Ordnance Safety Message Serial Number or Local Restriction Serial Number, is to be included on the Form EO 100.

Inspection of Guided Weapons

1.17 Guided Weapons (GW) often have special security requirements and are of high monetary and strategic value. They therefore require special precautions in storage and transportation. The precautions and associated procedures are detailed in Annex C.

Work-marking of Explosive Ordnance or Packages following Inspection

1.18 When EO and associated components are inspected, the inspector is to record the serviceability recommended on either Form EO 100 if the inspection is conducted within an EO Depot or on the inspection report if the inspection is conducted at a unit, as well as on the EO packaging or, if it is unboxed, on the EO itself, by applying inspection work-marks. The work-mark is an alphanumeric code applied by, or under the direction of, the responsible inspector. The primary function of inspection work-marks is to provide a clear audit link between the technical details of an inspection task and the actual items inspected.

1.19 A detailed explanation of work-marking, including format of, and methods for applying, work-marks is given in Procedure 2.

SENTENCING

1.20 Where a single critical or major defect is found during an inspection the defect is to be reported to EMB and the Condition Code of the entire lot is to be downgraded to ‘Pending”, awaiting further direction from EMB.

REPORTING

1.21 Form EO 100 or the monitoring audit report are used to report the results of an inspection. On completion of the inspection and subsequent sentencing of the inspected sample of EO the following conditions are to be reported to:

a. **No Defects Found.** To EMB.

b. **Minor, Major and Critical Defects.** All minor, major and critical defects must be reported in accordance with Regulation 1.3 Procedure 1 and to EMB.

NOTE

Immediate reporting of defects is essential because the supplier may be required to rectify the defect(s) under warranty arrangements.

Form EO 100 Explosive Ordnance Inspection or Test Report

1.22 Form EO 100 is a multi-purpose form to be used in reporting the results of inspection or testing of EO from an EO Depot to EMB. As all depots within Australia have COMSARM access, Form EO 100 is an electronic form housed within COMSARM. Instructions on the preparation, submission and processing of Form EO 100 are given on the Defence Secret Network (DSN) Intranet under COMSARM User Manuals.

1.23 For EO Depots without access to COMSARM, such as in an area of operations, the hard copy of Form EO 100 is to be utilised. Instructions on the preparation, submission and processing of the hardcopy Form EO 100 is given in Annex D. A specimen of the Form EO 100 is at Appendix 1 to Annex D.

Disposal of Records

1.24 Form EO 100 is to be retained for auditing purposes. Disposal of all such records is by application through CASG only.

Annexes:
A. Lotting and Batching of Explosive Ordnance
B. Examination of Installed Explosive Ordnance
C. Inspection of Guided Weapons
D. Preparation, Submission and Processing of Form EO 100

ANNEX A

LOTTING AND BATCHING OF EXPLOSIVE ORDNANCE

Introduction

1. Explosive ordnance (EO) supplied to or manufactured for Defence is required to be grouped into lots. A lot is a discrete quantity of EO or components that are as homogeneous as possible and under similar conditions of use may be expected to give uniform performance. A unique identity number, known as a Lot Number, is assigned to each lot.

2. A number of lots may be grouped into batches. A batch is a discrete quantity of EO that is assembled from two or more lotted components (one of which will be the primary batching component), is as homogeneous as possible and under similar conditions of use, may be expected to give uniform performance. A unique identity number, known as a Batch Number, is assigned to each batch. Within the batch, a number of sub-batches may be found. A sub-batch is a discrete quantity of EO within a batch that is formed when the secondary batching component lot number changes. A unique identity number, known as a Sub-batch Number, is assigned to each sub-batch.

3. The aim of the lotting and batching system is to:

a. Identify a homogeneous quantity of EO which should give uniform performance under similar conditions of use;

b. Reduce the manufacturer’s risk of large-scale rejection or warranty claims;

c. Facilitate the tracing, identification and withdrawal of EO that is life expired or has given unsatisfactory performance;

d. Identify a definite quantity for which the results of surveillance can be representative; and

e. Facilitate the establishment of technical and surveillance records.

4. The formation of a batch with respect to size, components to be recorded and mix of component lots used, may be found in the individual product specification for the EO concerned.

Procedure

5. When the Lot identity of ammunition cannot be established the following procedure is to be adopted in order that such ammunition may be identified for stock management purposes:

a. The ammunition is to be formed into Local Lots providing that:

(1) The ammunition is serviceable or able to be returned to serviceable condition;

(2) The ammunition in each Local Lot is confined to the same nature, type and mark or model and every effort is to be made to maintain the maximum homogeneity within each Lot, e.g. for Small Arms Ammunition (SAA) the round base stamp is to be the identifier, i.e. based on the manufacturer (monogram) and year of manufacture;

(3) It is certain that no existing restriction applies to the ammunition. (Advice may need to sought from the item sustainment manager); and

(4) The quantity in each Lot does not exceed the quantity normally contained in a Lot of manufacture.

b. Each Lot is to be allocated a Local Lot Number e.g. 005DEN11ADI09. This number is to be formed as follows:

ANNEX A

(1) '005' indicates the fifth Local Lot transaction by the unit in the year.

(2) 'DEN' denotes the station monogram for the EO depot Myambat where the Local Lot was produced.

(3) '11' represents the year (2011) the Local Lot was formed.

(4) 'ADI' denotes the station monogram of the original manufacture, Thales.

(5) '09' represents the year the ammunition was produced (filled).

c. Where insufficient information is available to allocate a Local Lot Number the item Sustainment Manager is to be contacted and if determined that the ammunition meets the requirements for Local Lotting as specified above, an agreed Local Lot Number shall be formed.

d. Each inspecting unit is to maintain a register for recording Local Lot Numbers. This reference is to be crossed referenced to the register of EO 100 forms.

e. Locally Lotted stocks are to be marked 'First Issue' and 'Training Use Only'.

f. All inner and outer packages are to be marked with the Local Lot Number but the original markings are to be left intact on the ammunition.

g. The Locally Lotted ammunition is to be packed in the approved pack and configuration of the original ammunition as detailed in Topic -025 of the item publication.

h. The relevant Form EO 100 is to detail the new Local Lot Number allocated, the method of repacking and any other relevant information such as the place and year of manufacture, if known, e.g. details found on the base of SAA, (ADI 99). The Form EO 100 is to be passed to the relevant item Sustainment Manager for confirmation of sentence and allocation of Life.

i. A confirmed copy of the Form EO 100 is to be retained by the item Sustainment Manager in lieu of the manufactures Ammunition Data Card.

j. All known relevant information is to be noted on any ammunition stock records.

k. The life of a Local Lot is to be based on the shortest life remaining that has been allocated to that type of ammunition produced by the manufacturer in that year of manufacture.

l. Locally Lotted ammunition which has not been expended within its allocated life is to be listed on a Form EO 100 which is to be forwarded to the item Sustainment Manager for review of sentence.

m. All Local Lotted ammunition is to be managed the same as for the original Lot, i.e. all restrictions that are applied to the original manufacturer Lot, year of manufacture, shall be applied to the Local Lot throughout its allocated life.

ANNEX B

EXAMINATION OF INSTALLED EXPLOSIVE ORDNANCE

Introduction

1. Pyrotechnics, other Explosive Ordnance (EO) and dangerous goods (collectively referred to in this procedure as EO) fitted to, or held in, aircraft, armoured vehicle or watercraft, or packed in safety and survival equipment, are to be inspected at regular intervals. As this EO is not always kept under ideal conditions of storage, it is necessary to adopt a system of inspection that will ensure, as far as practicable, that the EO remains safe and serviceable, and will function correctly when needed.

2. EO installed in fighting platforms, as described above, is not normally available for inspection. The installation of such EO is to be recorded in maintenance records or a Pyrotechnic and Installed EO Register. EO inspectors are to scrutinise these records, extract any relevant information and report any anomalies found.

Purpose

3. This procedure prescribes the policy for ensuring that EO fitted or held in various equipment and locations are brought forward for examination at regular intervals.

General

4. The procedure provides for:

a. A record of the EO held.

b. The marking of EO to record the date of issue.

c. A record of checks made to satisfy the requirements of any suspensions or restrictions that may apply.

d. A record of periodic examination.

5. Units using electronic maintenance tracking systems, such as Computer Aided Maintenance Management Version 2 (CAMM2) must make records available for review by inspectors, in either electronic or hard copy format. Hard copy records must be maintained for the period of the installed life of the EO.

6. Units not using electronic maintenance tracking systems are to record details of EO in a Pyrotechnics and Installed Explosive Ordnance Register in accordance with paragraph 12, or in accordance with any other authorised methods, e.g. Form TI 009 Inflatable Life-raft Log Card (refer to ANP 2703 – Royal Australian Navy Manual of Shipborne Lifesaving Equipment for the recording of EO fitted to Royal Australian Navy life raft survival packs.

Electronic Installed EO Registers

7. Electronic Installed EO registers may be used for the management of installed EO. The register must contain all of the fields specified in paragraph 12. The unit must be able to prove to the EO inspector’s satisfaction that the EO is being adequately managed through use of the electronic register. Details of the inspecting officer are to be attached to the electronic register (i.e. an enclosure that contains details of the inspecting officer, date of inspection and any remarks etc that is scanned and filed/stored with the register). The unit is to have these documents prepared for the EO inspector prior to the inspection occurring to allow these details to be completed at the conclusion of the inspection.

8. Details of the register and the inspection conducted are to be stored in Objective and are to be referenced by the Objective ID in the audit report.

ANNEX B

9. **CAMM2 Recording Procedure.** When user units are entering details of EO into CAMM2, the following procedure is to be carried out so that a CAMM2 'hard copy' report can be raised:

a. Raise an 'Asset Reception' on a new item.

b. Enter all details of the EO in the areas provided IAW AAP 7001.060-1-2 (AM1) – CAMM 2 Aircraft Maintenance Organisation, Section 3 Chapter 2 Paragraph 10.

c. Raise an 'Equipment Status Report' ensuring Maintenance Activities is ticked.

d. Print out 'Equipment Status Report' and do so for every subsequent maintenance activity.

e. Place 'hard copy' with pyrotechnics register so that both items can be inspected.

10. CAMM2 Asset Histories are also needed if the item of EO goes into a surveillance program at the end of its expired life.

11. CAMM2 reports may be transposed into an electronic format such as Microsoft Excel if deemed to reduce time spent on preparing CAMM2 hard copy reports. However, electronic registers must meet the requirements of paragraph 7 and 8.

Pyrotechnics and Installed Explosive Ordnance Register

12. Units holding EO installed are to maintain a Register in hard copy format of all such EO held. The Register is to contain the following information:

a. The type of EO issued, showing:

(1) Manufacturer or filler.

(2) Date of filling.

(3) Lot number.

b. The date on which the EO was first issued or installed, i.e. the commencement of the 'installed' life.

c. Dates on which the EO was examined and the signature of the EO inspector.

d. The life expiry dates, where applicable.

e. The equipment fitted to and registration/serial number of that equipment.

13. The Pyrotechnics and Installed Explosive Ordnance Register is to consist of Forms EO 087 Pyrotechnics and Installed Explosive Ordnance Register Sheet (see WEB FORMS) contained in a suitable binder.

Marking of Explosive Ordnance

14. To facilitate recognition of the date when the allotted life for each item of EO has expired, the issuing section is to ensure that the life expiry date of each store issued to an aircraft, pack, or personal equipment is clearly marked in a contrasting colour in the format month/year, e.g. 3/02. Expiry will be on the first day of the month. Stores may also be locally serial numbered as required.

Inspection by Unit Personnel

15. The authorised person responsible for maintaining a Pyrotechnics and Installed Explosive Ordnance Register, is to examine all EO listed therein at the following intervals:

a. Issues to aircrew – three monthly.

b. Safety and survival equipments – at each periodic servicing of the equipment.

c. EO fitted or stowed in aircraft, armoured vehicles and watercraft – regularly on a ‘routine servicing’ in accordance with the relevant Technical Maintenance Plan (TMP). If no TMP is available, the servicing interval is to be no greater than three monthly intervals. Experience with the particular equipment type may require this interval to be reduced.

16. Any EO found to be unserviceable or life expired is to be replaced immediately with serviceable stock. The unit is to dispose of unserviceable and life expired EO by returning the unserviceable items to the nearest EO storage depot.

17. The authorised responsible person is to enter in the Register the date when the examination was conducted, together with details of stock replacements.

Submission of Computer Records or Pyrotechnics and Installed Explosive Ordnance Register for Inspection

18. Pyrotechnics and Installed Explosive Ordnance Registers and other authorised documents that record details of installed EO are to be reviewed during audit of units’ EO holdings. The EO inspector is to sign and stamp the document or Register on completion.

Explosive Ordnance Safety Messages

19. On receipt of an Explosive Ordnance Safety Manages (EOSM)[1], the authorised person responsible for maintaining a Pyrotechnics and Installed Explosive Ordnance Register is to examine the Register, and identify if any of the subject EO is held. If the affected items of EO are held, the instructions included as part of the EOSM are to be complied with. Further information on EOSMs is found in Regulation 1.5 Procedure 3 Annex A.

[1] EOSMs are managed and released by the Explosive Materiel Branch (EMB) within the Capability Acquisition and Sustainment Group (CASG).

ANNEX C

INSPECTION OF GUIDED WEAPONS

Introduction

1. Guided Weapons (GW) often have special security requirements and are of high monetary and strategic value. They therefore require special precautions in storage and transportation. These precautions are essential to preserve the safety, serviceability, and operational effectiveness of GW.

Aim

2. This procedure details the procedures for the inspection of GW, as required by the Defence Security Principles Framework (DSPF) and Joint Systems Division (JSD) within the Capability Acquisition and Sustainment Group (CASG).

Authorisation for Inspection of GW

3. **Inspection Criteria.** Inspection criteria for GW are to be promulgated by JSD in the technical maintenance manuals for the relevant GW.

4. **Authorisation of Personnel.** Only personnel assessed as competent to do so may conduct the inspection of GW. Inspection personnel are to be formally authorised in writing in accordance with the relevant technical regulatory system.

5. GW are transported and stored in special-to-type authenticity sealed packaging to assist with ensuring security. This packaging may only be opened by:

a. Authorised employees of the Commonwealth, in an appropriately licensed and secure maintenance facility;

b. Defence user units;

c. Original Equipment Manufacturer (OEM); or

d. Contractor authorised by JSD.

Inspection by Command Security Personnel

6. Certain GW contain Controlled Cryptographic Items (CCI). These CCI's are in the charge of a Defence Security Branch (DSB) appointed Command Security (COMSEC) custodian. COMSEC requirements and policy are laid down in the DSPF.

7. The CCI GW inspection is conducted in accordance with COMSEC requirements and will include a visual inspection of the items to verify GW serial numbers, encryption chip serial number, documentation and that packaging tamper proof seals are intact. Each tamper proof security seal is serial numbered for traceability.

8. In accordance with COMSEC requirements, CCI GW will require inspection by COMSEC personnel:

a. On receipt into and dispatch from Australia;

b. Prior to all movements within Australia from storage, maintenance or Defence user units; and

c. During six monthly COMSEC muster.

9. In addition, COMSEC personnel will conduct a fortnightly visual inspection of CCI GW package tamper proof seals to verify the integrity of packages.

10. COMSEC personnel are to be notified prior to movements of, opening of, CCI GW packaging.

Authorised Maintenance Organisation Inspection Procedures

11. The complexity and security classification of GW necessitates the requirement for inspections to be conducted at an Authorised Maintenance Organisation (AMO) facility as follows:

a. Receipt Inspections, Pre-issue Inspections and Special Inspections are to be conducted by authorised storage facility personnel on the sealed GW packaging;

b. Maintenance Inspections, that include receipt inspection and return from user/broken seal inspections, are to be conducted on the packaged and unpackaged GW by authorised personnel from AMO maintenance facility, OEM or contractor;

c. Receipt Inspections, Special Inspections and User Inspections are to be conducted by authorised Defence personnel on the packaged and unpackaged GW; and

d. COMSEC personnel may conduct inspections on those GW in their charge.

12. **Routine Inspections.** Routine Inspections are not normally conducted on GW given that routine maintenance activities are at intervals likely to detect age related degradation mechanisms. Any item requiring Routine Inspections will have a surveillance plan promulgated by JSD and will be called up as a Special Inspection.

13. **Broken Seal Inspection Procedure.** If any authenticity seals are found to be broken or damaged, inspection personnel are to quarantine the package in an appropriate licensed and secure area with controlled access and ensure JSD is immediately notified. JSD is to arrange immediate access for authorised personnel to inspect the packaging and weapon. In addition, if any COMSEC tamper proof seals are found broken or damaged, inspection personnel are to isolate the packaging and immediately notify COMSEC personnel. Access to the packaging is to be denied until COMSEC personnel arrive.

14. **Inspection at AMO Maintenance Facilities.** AMO maintenance personnel are to conduct inspections on GW:

a. After maintenance due date expiry;

b. After failing storage facility Receipt Inspection;

c. After return from upgrade programs or OEM/contractor repair in accordance JSD instructions;

d. For new acquisitions with the Project Directive; or

e. As directed by JSD.

ANNEX D

PREPARATION, SUBMISSION AND PROCESSING OF FORM EO 100

Introduction

1. Form EO 100 is a multi purpose form to be used in reporting the results of inspection or testing of Explosive Ordnance (EO) from an EO Depot to designated logistics managers within the Explosive Ordnance Management Agency thus allowing inventory manager's oversight of the condition of their configuration items.

Aim

2. The aim of this procedure is to detail the requirement of Form EO 100 and inform the user on the steps required to complete the form.

When is Form EO 100 Required

3. An EO 100 is required to be completed in any of the following circumstances:

a. Receipt inspection of stores received direct from suppliers either domestic or foreign.

b. Receipt inspections of stores subject to maintenance or repair tasks.

c. Inspections resulting from a return of EO from a User Unit where stores are found to be of a condition other than serviceable.

d. Any EO inspection, conducted at a depot, where stores are found to be of a condition that is other than serviceable, including the conduct of Routine or Pre-issue inspections.

e. Repair or assembly tasks requiring downgrade of items or components.

f. On completion of all 'Remediation Tasks (previously known as 'Other than Serviceable') and all stipulated Non-Routine Maintenance (NRM).

g. Special inspection tasks as directed by the inventory managers or their delegates.

h. On completion of a Routine Inspection where the result is a defect classified as a minor, major or critical defect.

i. Creation of a local LOT.

j. Stores subject to an EOSM on return from User Unit.

NOTE

EO 100's are only to be submitted once tasks are completed, including all applicable Computer Support for Armament (COMSARM) configurations and transactions.

Electronic Version - Form EO 100

4. As a result of all EO Depots within Australia having access to the COMSARM system, Form EO 100 has been modified to become a fully electronic workflow tool, housed within COMSARM on the Defence Secret Network (DSN). The electronic version allows full visibility and tracking of the EO 100 through EO Depots. Instructions on the preparation, submission and processing of the electronic version are given on the DSN Intranet under COMSARM User Manuals.

ANNEX D

Paper Version - Form EO 100

5. For depots without access to COMSARM, such as ones located overseas, the EO 100 (available from Webforms) is to be completed in accordance with paragraph 6. The EO 100 is to be forwarded to the EO Safety and Reliability cell, Explosives Materiel Branch,

Compilation of Form EO 100

6. All fields on the EO 100 are to be completed. Appendix 1 contains a specimen of a hardcopy Form EO 100. Alpha identifiers located on the hard copy EO 100 correspond to the details given as follows:

a. **Explosive Ordnance Inspection or Test Report (a).** Why the EO 100 is being used to report in this particular instance. The originator is to strike out the incorrect response.

b. **EO 100 Serial Number (b).** A locally generated sequential number used to identify the particular EO 100 and the originator.

c. **Sheet (c).** This indicates the sheet number in a set of sheets assigned to that EO 100. For example sheet 5 of 7.

d. **Unit title and postal address (d).** The unit name and the postal address of the unit that conducted the inspection.

e. **Inspection or Test Authority (e).** The authority that the inspection or test was conducted in accordance with Topic 36.

f. **Purchase Order Number (f).** The purchase order number if the inspection is a result of receipting goods from a supplier.

g. **Transaction Number (g).** COMSARM assigned transaction number. Not required anymore due to the creation of the electronic EO 100 upgrade of COMSARM. Field should be left blank.

h. **Inspection Type (h).** Type of inspection that has been conducted. If ‘Other’ the details are to be entered in the remarks section (r).

i. **EO Safety and Reliability Incident Number (i).** The incident number if the inspection was initiated as part of a defect investigation.

j. **Item Number (j).** A sequential number assigned to the line of information on the EO 100 that is required for EO 100s that report multiple inspection results on the one EO 100. A separate EO 100 should be raised for each configuration item reported.

k. **Designation (k).** Identification details of the store that has been inspected or tested. Typical information entered is NSN, TSN and Lot Number etc.

l. **Quantity on Charge or Received (l).** Quantity held at the Depot/Testing Agency.

m. **Quantity Inspected or Tested (m).** Actual quantity inspected or tested.

n. **Quantity Serviceable (n).** The quantity determined serviceable as a result of the inspection/test.

o. **Expiry Date (o).** The expiry date of the lot inspected/tested.

p. **Quantity Not Serviceable (p).** The quantity that failed the inspection/testing.

q. **Condition Code (q).** Condition code recommended as a result of the inspection/test. Available condition codes are given in Regulation 2.3 Procedure 4 Annex C.

r. **Remarks (r).** Must include what document was used during the inspection as well as the criteria that the item sentenced against including any additional remarks or information that may be relevant to the inspection/test or the recommended condition codes assigned.

s. **Inspector (s).** Details of the EO Inspector who conducted the inspection/test.

t. **Safety Certificate (t).** Declaration that the inspected/tested EO is safe for storage and transport.

u. **Product Line (u).** Inventory managers or their delegate's sentence and any additional remarks.

v. **EO Safety and Reliability (v).** Confirmation that the EO Safety and Reliability cell has entered the received information into the applicable database for ongoing surveillance activities if required.

w. **Depot or EOS Action Report (w).** Depot or Joint EO Services acknowledgement of task competed.

7. The amount and level of information varies between the differing types of inspections that may be conducted with the following to be used as a guide in preparation:

a. **Receipt Inspection.** For receipt inspections involving a new item, or new package configuration, a package report (Form AE 141, available via Webforms) is required to enable creation of a packaging method, see Regulation 2.3 Procedure 2 Annex A for a more detailed description. Photographic evidence is to accompany Form AE 141. If there are more than one level of packaging, details of these packaging levels, including evidence of all markings and item package method are to be provided. This includes items that have over-packs or are packaged into cardboard cartons. Form AE 141 is to include evidence of the pallet configuration layout. Package reports are required when:

(1) New items are subject to receipt inspection

(2) The package type of the stores being inspected is not in accordance with the Topic -25 of the Item Publication or the Defence Explosive Ordnance Classification Listing (DEOCL).

or

(3) Requested by the Inventory Manager (IM) in which case the activity will be carried out under an EO 100 as Inspection Type – Other or Special.

NOTE

The package report will to be attached to the relevant EO 100 Inspection Report that is raised and both forms are to be provided to the designated logistics manager.

b. **No Technical Data or Inspection Criteria.** If an item is required to be inspected and there is no specific inspection criteria or technical data available, an EO 100 is to be raised advising Defence of the depot's inability to conduct inspection and referencing the lack of data using the recommended Account Code for No Technical Data i.e. Receipt Inspection Tech Data (RITD) or Return No Tech Data (RETTD).

ANNEX D

Return of Form EO 100

8. In the event that a submitted EO 100 is not returned within 20 working days then hastening the responsible Defence inventory manager may be required. Upon receipt of the confirmed form back from the inventory manager, it is to be reviewed for accuracy and completeness.

9. Once the completed EO 100 has been received, further physical action is to be completed as applicable, e.g. warehouse transfers or placarding.

Records and Registers

10. There is no requirement to maintain an EO 100 register. However, Depots may choose to hold a register to assist in tracking consecutive numbers. The EO 100 register may be kept in hard or soft copy as required by the depot. If hard copies are used they are required to be kept up to date at all times. Once all actions have been completed on the returned EO 100, a copy is to be kept in the applicable transaction folder.

Appendix:
1. Specimen of Form EO 100

Classification

Department of Defence

Explosive Ordnance *Inspection or Test Report *(a)*

EO 100 serial number *(b)*	Sheet *(c)* of

Unit title and postal address *(Of unit conducting inspection) (d)*		* Inspection or test authority *(e)*	
Purchase Order (PO) number *(If applicable) (f)*	**Inspection type** *(h)* * Routine inspection * Special inspection * Other *(Specify)* * Pre issue inspection to * Receipt inspection from * Return inspection from	Date of inspection or test	GWEO AS&P incident number *(If applicable) (i)*
Transaction number *(g)*		Unit inspected	Item IRN / Item IRN / Date entered

Item number *(j)*	Designation (To include NSN or TSN, lot number and component details) *(k)*	Quantity * on charge or * received *(l)*	Quantity * inspected or * tested *(m)*	Quantity serviceable *(n)*	Expiry date *(o)*	Quantity not serviceable *(p)*	Condition code *(q)*	Remarks *(To include: quantity and specific reasons for awarding sentences, reference to attached supporting documentation and may recommend disposal code in accordance with DEOP 106 Section 2, Chapter 2, Table 2-1). (r)*

SPECIMEN

Inspector *(s)*
I certify that the quantities recorded in columns *(l)*, *(m)*, *(n)* and *(p)* have been sentenced in accordance with instructions and show no indication that abnormal handling, storage and/or transportation arrangements are required.

Signature	Date
Printed name	IIC

Safety certificate *(t)*
Item(s) quantity considered unsafe for * handling, storage and/or transportation.

Signature	Date
Printed name	IIC

GWEO product line *(u)*

Date received

☐ Confirmed ☐ Not confirmed

Signature	
Printed name	Date
Remarks *(Including account code allocation)*	

AS&P *(v)*

Inserted in ISS database	Inserted in propellant database
Remarks	

Depot or EOS action report *(w)*

Signature	
Printed name	Date

* Delete not applicable

PROCEDURE 2 - WORK-MARKING EXPLOSIVE ORDNANCE, ASSOCIATED COMPONENTS AND PACKAGING

Introduction

2.1 To enable identification of Explosive Ordnance (EO) and associated components that have been inspected, repacked, repaired, tested or rendered/certified inert, identification markings are applied to the packages for the EO and associated components or onto the EO if it is unboxed. These identification markings are known collectively as a work-mark. The primary function of a work-mark is to provide a clear audit link between the technical details of the task and the actual items that were inspected or worked in any way, eg repacked, certified free from explosives etc.

2.2 Individual Services and organisations using Computer Support for Armaments (COMSARM) may have differing requirements for identifying work conducted i.e. personal signature or electronically posting the transaction in the case of electronic EO 100s. These requirements are acceptable within the boundaries of that Services environment and scope of the particular task.

2.3 A work-mark is the process of affixing an identifiable, traceable mark, eg an alphanumerical code, onto the EO or packages, as appropriate, by an operator who has been authorised as competent to undertake the particular task in question.

Purpose

2.4 The purpose of this procedure is to detail the:

a. Requirement for, and method of work-marking packages for EO and associated components, and unboxed EO.

b. System for issue and control of Inspector Identification Codes (IIC) and work-marking kits.

Work-marking – Qualified EO Inspector

2.5 Inspection work-marks are applied by or under the direction of a qualified EO Inspector[1]. Inspectors are issued with a unique IIC that form part of the applied markings. Work-marking is the process of affixing an alphanumeric code to EO or packages, as appropriate.

2.6 A work-mark identifies the EO Inspector who undertook or supervised the activity, the establishment where the activity was performed, the date on which it was conducted and when applicable, the serial number of the documentation.

2.7 A secondary function of work-marks is to make all personnel involved in inspection activities aware of their accountability for the work performed or supervisory role undertaken, and to provide also a measure of guarantee of safety and quality of the EO subjected to the inspection.

2.8 When EO and associated components are inspected and the condition of those stores, in the opinion of the EO Inspector has changed, the Inspector is to record that recommendation on appropriate documentation (eg Form EO 100 Explosive Ordnance Inspection or Test Report) and on the packages for the EO and associated components or on the EO if it is unboxed, by applying a work-mark. Documents and labels certified by EO Inspectors are also to be stamped with the IIC using the inspector's IIC rubber stamp.

2.9 **Format of a Work-mark.** Inspection work-marks for EO, associated components and packaging, as appropriate, are to be applied in a standard format comprised of the following information and in the layout described at subparagraph f:

---

1 An EO Inspector is a member who has competencies in the theory of design, technical and operational limitations, build standard and storage requirements on EO and is authorised to undertake technical inspection, maintenance and sentencing of EO.

a. **INSP and Condition Code.** The abbreviation INSP indicates the EO has been subject to an inspection and an abbreviation of the Condition Code i.e. sentence, recommended by the EO inspector. The Condition Codes are promulgated in Regulation 2.3 Procedure 4 Annex B.

b. **Inspector Identification Code.** An alpha numeric code formed from up to four digits or letters or a combination thereof unique to the EO inspector who supervised or conducted the task. IIC are recorded in a register maintained by the Manager EO Technical Services (MEOTS) in the Directorate of Explosive Ordnance Services (DEOS) - see paragraph 2.20. In addition to the four digit code, a suffix may be added to the end of the four digit code in order to recognise personnel conducting the 'Reject Endorser'[2] function in guided weapons maintenance. In this case the IIC would appear as 'XXXXR', where 'XXXX' is the IIC and 'R' indicates an authorised Reject Endorser.

c. **Station Monogram.** The authorised station monogram for the unit/establishment where the maintenance/inspection activity is performed (or in some instances the organisation which undertakes the inspection. These monograms are shown in ESTC Pamphlet 5 which can accessed through the Defence Explosive Ordnance Classification Listing (DEOCL).

d. **Date of Inspection.** A four digit numerical representation for the month and year the inspection activity is performed, e.g. 05/01 represents May 2001.

e. **Form EO 100 Serial Number.** The serial number of the Form EO 100 applicable to the inspection of the EO whenever either form is raised. The serial number takes the following form with each component of the number separated by a slash:

The station monogram for the establishment at which the inspection or test activity was performed/a number representing the Form EO 100 transactions for that calendar year beginning at 001 and running consecutively throughout the year/a two digit representation for the year during which the inspection or test activity was performed, e.g. DEN/02/005 (indicates an inspection conducted at Defence Depot Myambat, during calendar year 2002, is the fifth Form EO 100 transaction).

f. **Work-mark Layout.** An inspection work-mark is formed as follows with the various components of the work-mark separated by a slash:

INSP(Condition Code)/IIC/Station Monogram/Date
Form EO 100 Serial Number (if applicable).

2.10 Examples of Work-marks. Examples of work-marks to be applied to EO, associated components and packages are as follows:

a. **INSP(N)/Z007/OHL/10/02**
OHL/02/023

(The work-mark indicates that an EO Inspector assigned IIC Z007 recommended a change of condition for the EO to Not Repairable at Defence Depot Orchard Hills in October 2002 – details available on Form EO 100 Serial No OHL/02/023).

b. **INSP(R)/481/STI/06/01**

(The work-mark indicates that that an EO Inspector assigned IIC 481 recommended that the condition for the EO remain as Repairable at HMAS Stirling WA in June 2001).

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2 Reject Endorser is an American term for personnel working in the GWMA who are authorised to reject a single or multi step process in guided weapon maintenance such that either a single process or multi processes can be recommenced without the need to begin the complete process all over again.

c. **INSP(S)/235/TVL/08/99 TVL/99/027**

(The work-mark indicates that an EO Inspector assigned IIC 235 recommended a change of condition for the EO to Serviceable at RAAF Townsville in August 1999 – details available on Form EO 100 Serial No TVL/99/027).

Work-marks for Repair, Repack, Test and Rendering/Certifying Inert Tasks

2.11 Work-marks for repair/modification, repackaging, testing and rendering/certifying inert tasks are to be applied only by or under the direction of an EO Inspector authorised as competent to undertake the particular task in question.

2.12 **Format of Work-marks.** The format of work-marks for repair, repack, test and rendering/certifying inert tasks is as for inspection work-marks except that INSP is replaced by one the following abbreviations, as appropriate. Also, for INERT work-marks the date component is replaced by a registration number/year designator – see Regulation 2.4 for details:

a. REP for EO that has undergone a repair program, e.g. re-fuzing, marking modifications etc.;

b. PACK for EO that has been repackaged;

c. T for EO that has been subject to a test; or

d. INERT for EO that has been rendered or certified inert - see Regulation 2.4.

2.13 **Examples of Work-marks.** Examples of repair, repack, test and rendered/certified inert work-marks are as follows:

a. REP(S)/Z007/OHL/10/02.

b. PACK(S)/481/STI/06/01.

c. TEST(R)/235/TVL/08/99.

d. INERT/323/PWF/02/027.

Application of Work-marks

2.14 The application of work-marks to packages for EO and associated components, unboxed EO or documentation and labels is to be by one or more of the following methods as appropriate:

a. Stencilled or handwritten (block lettering) markings.

b. Rubber stamps.

c. Printed labels.

d. As specified for the particular activity, e.g. for EO rendered inert, specific requirements are detailed in Regulation 2.4.

2.15 Work-marks should normally be stencilled but may be handwritten in field operations. The size and colour of work-marks is detailed in Regulation 2.3 Procedure 5 and Regulation 2.4, depending on the activities in question. Work-marks on guided weapons may be applied to labels affixed to the outside of packaging and therefore may not strictly comply with the aforementioned size and colour requirements.

Authenticity Sealing of Packages

2.16 All EO and associated component packages bearing work-marks are to be authenticity sealed as detailed at Regulation 2.3 Procedure 4. This will externally signify the package contents have not been tampered with since the last task was conducted on the EO. All packages with broken or missing authenticity seals are required to undergo inspection for quantity and condition prior to further storage, handling or transportation.

Marking of Documents and Labels

2.17 All documents and labels certified by an authorised EO Inspector are to be marked with the IIC using an IIC rubber stamp - see paragraph 2.18.

PROCEDURE FOR ISSUE AND ACCOUNTING OF INSPECTOR IDENTIFICATION CODES AND WORK-MARKING KITS

Introduction

2.18 Authorised EO Inspectors will be issued with individual IIC for work-marking purposes and be provided with a Work-Marking Kit comprised of the following items:

a. A 20 mm (approximate dimension) rubber IIC stamp.

b. Sealing press with Station Monogram die set (if required).

c. Paint stencils (manufactured as required).

Impressions of, and format details for, the IIC rubber stamp are given at Annex A.

Supply of IIC and Work-Marking Kits for DEOS Personnel

2.19 DEOS (MEOTS) is the controlling authority for the provision and distribution of all IIC and work-marking kits for DEOS personnel. IIC and work-marking kits used by EOS staff in regional JLU will be retained and managed by EOS managers, their staff will be issued IIC and work-marking kits when they commence duty in a region in order to meet Authorised Maintenance Organisation requirements and the IIC and work-mark kits are to be returned upon posting. Requirements for IIC arrangements for EO Services Providers and other non-DEOS personnel are detailed at paragraphs 2.22 to 2.24.

2.20 DEOS (MEOTS) is to maintain a register of all Australian Defence Force (ADF), Joint Proof and Experimental Unit (JPEU) employees and EO Services Providers' personnel issued with IIC. EO Services Providers and non-DEOS ADF EO Inspectors are to provide details of IIC issued to personnel to DEOS (MEOTS). A summary of IIC in use will be published under restricted distribution in a DEOS publication. All issues of IIC are to be signed for by the members concerned.

2.21 An EO operator's IIC will be unique to the individual during the period of issue.

Work-marking Arrangements - EO Services Provider and Non-DEOS Personnel

2.22 The EO Services Provider, JPEU and non-DEOS ADF elements (e.g. Training Command – Army (TC-A) etc.) are to establish an issuing authority responsible for the introduction, accountability and maintenance of IIC and work-mark kits similar to those detailed in this instruction.

2.23 The EO Services Provider, JPEU and non-DEOS ADF elements are required to provide to the DEOS (MEOTS) a list of all authorised EO Inspectors issued with an IIC, who will be employed on the inspection, repair, repack or testing of EO held for, or on behalf of, Defence. The list is to be updated as necessary, with any loss of IIC stamps or dies to be notified promptly. This list will also include personnel authorised to certify inert or render EO inert.

2.24 The EO Services Provider's, JPEU and non-DEOS ADF elements IIC rubber stamps are to be similar in form and size (but may be either larger or smaller if required) to those specified in Annex A. EO Services Provider rubber stamps are to identify the contractor by name.

Working Arrangements - Authorisation of Air Force Personnel

2.25 **Personnel Authorised to Inspect, Repack and Reseal Packed EO.** The Commanding Officer (CO) is to authorise each member to act as an Air Force personnel, who as part of their duties, are to inspect, repack and reseal packed ADF EO. The CO's authorisation is to be granted by Minute or Routine Instruction every 12 months. The authorised member must meet the qualification criteria in accordance with Regulation 2.3 Procedure 3.

2.26 **Personnel Authorised as an Air Force Inspector of Explosives.** The CO is to authorise each member to act as an Air Force Inspector of Explosives, who as part of their duties, are to supervise inspection and repacking and resealing operations conducted on ADF EO. The CO's authorisation is to be granted by Minute or Routine Instruction every 12 months. The authorised member must meet the qualification criteria in accordance with Regulation 2.3 Procedure 3.

2.27 The authorised member is to present the CO's authorisation to the local Base Armament Manager (BAM), requesting the issue of an individual Air Force work-mark with the members unit and unique identification number. See Annex A for a sample of the Air Force work-mark.

2.28 The work-marks are to be funded by the requesting unit. Work-marks are to be tracked by the BAM. The BAM is to submit an annual report showing all currently issued stamps and the associated details of the members, to the Senior Inspector Explosives (SIX), DEOS.

2.29 On posting or withdrawal of the authorisation, the individual work-mark is to be returned to the BAM. Once the work-mark is returned, the work-mark identification number is to be quarantined for at least 12 months prior to being made available for re-issue to another authorised person.

2.30 **Personnel Authorised as a Defence Inspector of Explosives.** A member qualified in accordance with paragraph 2.26 is to submit a minute to the SIX requesting authorisation as a Defence Inspector of Explosives for the duration of their posting, in-order to inspect, repack, reseal, sentence and certify safe to transport, ADF EO.

2.31 Additionally, those members posted to Explosive Ordnance Disposal Flight (EODF) positions who satisfy the requirements of paragraph 2.26 and are qualified Explosive Ordnance Disposal Technicians may be authorised to declare fired/functioned FFE and safe for transport, non-ADF EO.

2.32 **Layout of Work-marks**. Work-marks issued in accordance with paragraphs 2.26 – 2.29 are to be a self-inking style of stamp and formatted as indicated in the sample contained within Annex A. The unit name is to be positioned under the coat of arms and the unique work-mark number is to be a three digit number followed by a capital G.

Safe Custody of Stamps, Sealing Presses, Dies and Documents

2.33 The safe custody of all components of work-marking kits issued to authorised EO Inspectors is the responsibility of the individual concerned. Stamps and sealing dies are not to be left unattended and are to be kept under lock and key when not in use.

2.34 Stamps and sealing dies held in reserve and all accounting documents are to be kept in safe custody when not in use.

2.35 On posting to a unit, authorised EO Inspectors are to be issued dies (if required) for the relevant station monogram by the relevant issuing authority. The station monogram dies are to be surrendered by Inspectors when departing the unit. ADF or EO Service Providers' EO Inspectors may retain their IIC stamps until withdrawn by the issuing authority.

Loss of, and Unserviceable Stamps and Sealing Dies

2.36 The loss of stamps or sealing dies is to be reported immediately in writing to the issuing authority who is to take whatever action is considered appropriate.

2.37 All unserviceable stamps and sealing dies are to be returned to the issuing authority for replacement. The returned items are to be destroyed in accordance with paragraph 2.41.

2.38 DEOS (MEOTS) can provide advice for the replacement of stamps and sealing dies (if required).

Withdrawal of Stamps, Sealing Presses and Dies

2.39 **DEOS Personnel.** When a DEOS member with a current issue work-mark kit leaves a position of employment as an EO Inspector, the IIC and work-mark kit is to be returned to the issuing authority. The IIC is then to be quarantined for at least one year before it may be re-issued. If during the quarantine period the original holder returns to EO duties requiring the application of work-marks and is assessed as current, that operator may be re-issued his or her original IIC and work-mark kit.

2.40 **Non-DEOS Personnel.** When an ADF member, JPEU employee or an EO Services Provider personnel, who is issued with a work-mark kit ceases employment, the work-mark kit is to be returned to the issuing authority or DEOS (MEOTS) for disposal action in accordance with paragraph 2.41. Individual IIC may also be quarantined as per the previous paragraph depending on the individual requirements of the ADF or EO Services Provider.

Disposal of Stamps and Sealing Dies

2.41 Stamps and dies that have been identified for disposal are to be destroyed by the issuing authority so that reconstitution is impossible. The methods of disposal are left to the discretion of the issuing authority, provided that the working face of the stamps or dies are totally obliterated. The issuing authority is to use the destruction certificate, found at Annex B - Inspector Identification Code Stamp Destruction Certificate, to document the destruction of the stamps or sealing dies. Destruction certificates are to be retained for audit purposes.

2.42 Issuing authorities are to conduct an annual census of all IIC stamps, including all items held in reserve.

Annexes:
A. Inspector Identification Code Rubber Stamp
B. Inspector Identification Code Stamp Destruction Certificate

ANNEX A

INSPECTOR IDENTIFICATION CODE RUBBER STAMP

ANNEX B

INSPECTOR IDENTIFICATION CODE STAMP DESTRUCTION CERTIFICATE

Identification Number:	Issued To:
Date Issued:	**Date Withdrawn:**

All stamps and sealing dies for________________ *(Ident #)* have been withdrawn from service and destroyed in accordance with Regulation 1.5 Procedure 2, paragraph 2.29

Disposal Method:	Date Destroyed:
Destroyed By *(Name)*:	**Location:**

To be completed by the member conducting disposal.

____
(Signature)

____
(Rank & Name)

____
(Appointment)

____
(Date)

To be completed by Issuing Authority.

____
(Signature)

____
(Rank & Name)

____
(Appointment)

____
(Date)

PROCEDURE 3 - DEFECT CLASSIFICATION AND SENTENCING

Introduction

3.1 The Defect Classification and Sentencing system for Explosive Ordnance (EO) provides Explosive Materiel Branch (EMB) within the Capability, Acquisition and Sustainment Group (CASG), EO service provider personnel, EO Inspectors and technical personnel with a standard classification and coding system when conducting, or analysing the results of, inspection activities.

Aim

3.2 The aim of this procedure is to describe the EO defect classification and sentencing system.

Scope

3.3 This procedure details:

a. The system of EO defect classification.

b. Sentencing codes following the inspection of EO.

c. EO disposal method codes.

Defect Classification

3.4 **Defect.** A defect, for the purposes of EO inspection, is any non-conformity against defined requirements of the EO, its components or packaging. Defects are grouped into the following classifications:

a. **Critical Defect.** A critical defect is one that is:

(1) Defined in the item's inspection criteria in the relevant maintenance publication.

(2) In the judgement of the EO inspector, it is determined there could be an unsafe condition or hazard that could result in death, injury and/or damage to property or equipment during handling, storage and use of the EO. Examples include the absence of safety devices or blank Small Arms Ammunition (SAA) contaminated with ball ammunition. Critical defects are to be actioned immediately.

b. **Major Defect.** A major defect is a serious fault, other than critical, that can result in failure, or materially reduce the useability of the EO for its intended purpose. An example is partially filled charge bags for use in artillery.

c. **Minor Defect.** A minor defect is any fault which does not materially affect the functioning or performance of EO but involves minor departure from specifications that may affect efficient logistics management of the item though its Life of Type (LOT) or, if left uncorrected may become a major defect. Examples include minor corrosion on SAA or minor marking errors on 105 mm cartridge cases.

3.5 **Other Occurrences.** Some anomalies in the appearance of EO, or its packaging, whilst noticeable, may be considered sufficiently insignificant to be classified as a minor defect. Examples are:

a. Small scratches or dents

b. Spots of rust or corrosion

c. Minor pitting and small tears or splits

d. Variations in size and colour of markings

e. Damaged paintwork or varnish where this does not make the round or component vulnerable to major corrosion or rusting

f. Damaged paint, provided the markings are legible or

g. Minor damage to clips, handles, strapping or other elements of packaging.

In these cases the need to report these occurrences as minor defects is to be assessed on a case by case basis, at all times considering the possibility of decreased safety or operational effectiveness, or increased through-life support costs, if not rectified

NOTE

For initial receipt inspection all observations or defects must be reported even if these do not affect the overall condition of the EO. Such reporting is necessary to meet warranty obligations.

3.6 Assessing the Classification. In assessing the classification of the defect, the criteria should be based on the ability to issue the EO. The EO Inspector is to consider whether the EO can be issued without remedial action. When the answer is 'yes', it follows that any defects found are to be recorded as minor. When the answer is 'no' the EO inspector is to decide which defect classification to apply.

Sentencing of Explosive Ordnance

3.7 Condition Codes. Sentencing is the process of allocating a Condition Code to EO based on the findings of an inspection. The Condition Codes are defined in Regulation 2.3 Procedure 4 Annex B.

3.8 Critical or Major Defects Found. If a Critical or Major defect is found, as opposed to handling or user damage, the whole batch/lot of the item in question is to be suspended from issue and segregated pending further investigation and advice from the EMB. In this case the batch/lot is to be locally suspended from further use. Where the EO is found to have handling or user damage the EO is to be sentenced in isolation from the remainder of the batch/lot and locally suspended from further use.

3.9 Minor Defects. If no Critical or Major defects are found on completion of an inspection, the EO is to be sentenced 'Serviceable'. In instances where only minor defects are found the EO may also be sentenced 'Serviceable'. However, for initial receipts, all minor defects must be reported.

Reporting of Defects

3.10 All defects found are to be reported in accordance with Regulation 1.3.

Notification of Defects for the wider Defence Community

3.11 When the EMB receives notification of a defect that may affect items stored within other EO Depots or establishments, an EO Safety Message (EOSM) is to be issued to all users. Annex A contains additional details and guidance on the management of EOSMs.

3.12 The purpose of an EOSM is to inform EO Depots and Users that the item of EO is in a condition that is no longer considered 'serviceable' as it is. This condition could range anywhere from a critical defect, to unable to perform to the required specified outputs but is still acceptable for use in the training environment. EOSM can also be used to communicate to users any safety related concerns and the associated risk reducing measures required i.e. use of additional personal protective equipment, until such times as the item publication has been amended.

3.13 The EOSM issued will be one of the two following types:

a. **EOSM-Suspension.** The EOSM-Suspension informs the EO Depot or user that the item of EO has been suspend from use. It will include directions i.e. Suspended from issue and use, safe to store and transport, return to the nearest EO Depot at the earliest opportunity etc.

3.14 EOSM-Restriction. The EOSM-Restriction informs the EO Depot or user that the item of EO has an issue that requires special consideration i.e. not cleared for overhead fire, Training Use Only or use Personal Protective Equipment is required etc. EOSMs are available for viewing in the Explosive Ordnance Technical Publications (EOTP) library.

Annex:

A. Management of Explosive Ordnance Safety Messages

ANNEX A

MANAGEMENT OF EXPLOSIVE ORDNANCE SAFETY MESSAGES

Introduction

1. Explosive Ordnance Safety Messages (EOSM) are a rapid means of advising Inventory Managers, Stockholders and Users of changes to an item of Explosive Ordnance (EO) which are found to be or suspected of being other than serviceable, have its performance degraded or is unsafe for use, is withdrawn from normal use and its condition/serviceability appropriately reclassified or qualified. The purpose of the EOSM system is to prevent the issue or use of affected EO for any purpose other than for disposal, rectification or mitigation action. EOSMs provide the ADF with a system to inform all EO Depots and Users that an item of EO has had an immediate change to its condition and can no longer be considered to have the same technical integrity as it had previously. This condition could range anywhere from a safety issue, a critical defect or a performance issue. EOSMs can also be used to rapidly inform of any special measures identified that are required to be taken with regards to the EO in order to continue its use. It is essential that these messages are circulated quickly to ensure users do not unknowingly operate or subject others to defective EO.

Aim

2. The aim of this procedure is to describe the EOSM system.

Scope

3. This procedure details:

a. Three types of EOSMs as follows:

(1) EOSM – Suspension.

(2) EOSM – Restriction.

(3) EOSM – Cancellation.

b. Notification of EOSMs to the EO Depots and Users.

c. EOSM Numbering.

d. EOSM Layout.

e. Action on receipt of an EOSM.

f. Cancellation of an EOSM.

g. Out of sequence EOSM.

h. Consolidation of EOSMs.

EOSM - Suspension

4. The EOSM – Suspension informs the EO Depot and User that the item of EO has been suspended from use. It will include directions i.e. suspended from use, safe to store and transport, return to the nearest EO Depot at the earliest opportunity.

5. When EO fails to perform to specification or is suspected of being unreliable or unsafe, it must be immediately withdrawn from use and is to be suspended from a ‘serviceable’ condition or its serviceability is to be qualified. Indications of a change in the condition of the EO may result from the defect reporting action via an EO 016, proof test results, manufacturers’ reports or from advice from other Australian and Overseas Defence Users. EOSMs are used as a rapid means of initially advising stockholders and users of EO safety or performance issues. See Regulation 4.8 Procedure 1 Annex B – Suspension Cards for actions to be taken on receipt on an EOSM – Suspension and for the use of Suspension Cards, Form AE 468.

6. **Local Suspensions.** When a defect is identified with an item of EO, it is to be classified in accordance with Regulation 1.5 Procedure 3 and reported via Form EO 016 in accordance with Regulation 1.3 Procedure 1. The affected items are to have a locally raised Suspension Card (Form AE 468) placed on the stack to assist in the prevention of the items being issued or used until the incident has been fully investigated. The outcome of the investigation may result in an EOSM – Suspension being issued. Local suspensions can be cancelled by the stockholder when the need arising for them has passed or as instructed by an EOSM initiated by EO Safety and Reliability. Local suspension registers are to be kept and held at the unit; however, entries into the local suspension registers will not be consolidated into the EOSM Master Register, held by the EO Management Agency and available on the EOSM webpage.

EOSM - Restriction

7. The EOSM – Restriction informs the EO Depot and Users that a special instruction must be complied with in order to continue using that particular item of EO. This could be for any of following reasons:

a. The EO has to undergo an inspection prior to issue or use

b. Some form of personal protective equipment needs to be worn

or

c. The EO has degraded in performance but not safety and can now only be used for training purposes and not Operational use.

NOTE

The above list is not exhaustive. There may be other scenarios which may result in an EOSM – Restriction being issued.

8. See Regulation 4.8 Procedure 1 Annex C – Restriction Cards for actions to be taken on receipt of an EOSM – Restriction and for the use of Restriction Cards, Form AE 467.

EOSM – Cancellation

9. The EOSM – Cancellation informs the EO Depot and Users that the suspensions or restrictions imposed by previously issued EOSM have been cancelled. The EOSM - Cancellation will have the signal date/time reference noted against it in the EOSM Master Register. Should immediate access to the EOSM Master Register not be available, an uncontrolled copy of the cancellation signal may be kept for future reference. These personnel holding an uncontrolled copy of the EOSM Master Register may annotate the signal date/time reference against the cancelled EOSM.

Notification of EOSMs to the EO Depots and Users

10. The responsibility for the issue of EOSMs lies with EO Safety and Reliability cell within the Explosive Materiel Branch (EMB) in Capability Acquisition and Sustainment Group (CASG). The EOSM will be issued immediately via signal and a copy placed in the EO Technical Publications (EOTP) library. On receipt of an EOSM signal a copy is to be kept until the library has been updated.

EOSM Numbering

11. EOSMs are numbered consecutively commencing each calendar year e.g. '1300001' is the first message issued in 2013. The final serial number in any one year will be advised in the initial message of the succeeding year.

ANNEX A

EOSM Layout

12. EOSMs are issued in the following format:

SUBJ: ADF EXPLOSIVE ORDNANCE SAFETY MESSAGE (EOSM) – RESTRICTION/SUSPENSION/CANCELLATION

A. Reference

B. Reference (If required)

C. Reference (If required)

1. THE FOLLOWING ITEM IS RESTRICTED/SUSPENDED/CANCELLED Forthwith.

2. ADF EOSM Number YYXXXXX e.g. '1300001'. (There is no EOSM number for an EOSM CANCELLATION).

A. Type of reclassification e.g. 'Suspension, Restriction or Cancellation'

B. NSN, ASN, and/or TSN

C. Item Name

D. LOT or Serial Number

E. Details of EOSM reclassification requirements i.e. Reason for Reclassification and Instructions

3. PREVIOUS EOSM ISSUED WAS YYXXXXXX.

4. ACTION MESSAGE ON RECEIPT OF AN EOSM OR CANCELLATION e.g. a watch copy is to be placed in the register until online version is updated.

5. A CONSOLIDATED LIST OF ALL EOSM INCLUDING NAVY EORM, ARMY AS, UAC AND TAC, AND RAAF EORM MAY BE FOUND ON THE EOSM MASTER REGISTER AT THE TRI-SERVICE EOSM WEB-SITE.

6. QUERIES WO INCIDENTS AS&P (02) 4726 1164

Actions on Receipt of an EOSM

13. The received EOSM is to be actioned in accordance with Regulation 4.8 Procedure 1. Holders of the signal are to ensure that details of the EOSM are actioned immediately on receipt. Failure to do so could have serious consequences. Detailed procedures for the implementation of the EOSM are contained in the signal. In all instances, instructions contained in the EOSM are to be implemented without delay by the Inventory Mangers, Stockholders and the Users of the EO, by appropriate checks against all stock holdings. The message is to be annotated with a 'Note of Action' of whatever action was taken, e.g. Pyrotechnics Register checked, stock identified, segregated and EOSM-Suspension Card attached. The EOSM is then to be filed for future reference.

Out of Sequence EOSMs

14. When EOSM signals are received out of numerical sequence, recipients are to check the EOSM website consolidated list for the missing signal. If the missing signal is not available contact AS&P immediately for rectification.

Consolidation of EOSMs

15. A register of all EOSMs active and cancelled can be found in the EOTP library website. This website contains a Master Register containing the Consolidated List of EOSMs and previously known Navy and RAAF EORMs and Army's Suspensions, User Ammunition Constraints and Technical Ammunition Constraints. Units receiving EO which have an EOSM applied to the EO are to consult the EOSM Master Register to determine the details of the Restriction or Suspension. This can be easily achieved by searching the Master Register using the filter arrow and selecting the TSN/ASN or NIIN.

REGULATION 2.1 - HAZARD CLASSIFICATION OF EXPLOSIVES

General Overview

1.1 The United Nations (UN) System for classifying dangerous goods for transportation consists of nine classes of which Class 1 comprises explosives. The other classes are: gases, flammable liquids, flammable solids, oxidising substances, poisonous and infectious substances, radioactive material, corrosive substances and finally, miscellaneous dangerous goods. The Class 1 (Explosives) classification system is also used by Defence for storage. A comprehensive description of the UN System is contained in UN publication *Recommendations on the Transport of Dangerous Goods—Model Regulations,* ST/SG/AC.10/1 (as revised) (Orange Book) and is supplemented by publication ST/SG/AC.10/11—*Manual of Tests and Criteria*, which gives descriptions of the test methods and procedures for the classification of certain types of dangerous goods (including explosive substances and articles) for transport. As well as classifying dangerous goods in accordance with the major hazard posed, the UN System allocates a four digit UN number and proper shipping name to substances or articles listed in the Orange Book. The UN number provides a quick means of identifying classified dangerous goods and it is used for regulatory correlation purposes with transport mode specific information systems, e.g. International Air Transport Association and Inter-Government Maritime Consultative Organisation.

1.2 AASTP-1 Manual of NATO Safety Principles for the Storage of Military Ammunition and Explosives defines an international system for classification of EO for storage. This system is based upon the UN system but refines the criteria providing for storage sub divisions.

Requirements

1.3 All Commonwealth explosives determined as Defence EO is to be classified prior to all modes of transport and prior to storage in Defence-owned or leased facilities in accordance with the;

a. The UN System and AE Code for transport, and

b. Principles of AASPT-1, as modified by the Explosives Storage and Transport Committee (ESTC), for storage,

except for Depleted Uranium EO which is not permitted to be transported, stored or handled in Australia. The requirements of the UN System and the AASTP-1 storage sub divisions are detailed at Annex A.

1.4 Procedures will be developed to ensure hazard classification is achieved for;

a. New items of EO;

b. New Explosive Substances;

c. Reclassification of EO.

1.5 Hazard Classifications are to be promulgated at least quarterly via the ESTC pamphlet No 2—*Defence Explosive Ordnance Classification Listing* (DEOCL).

1.6 The DEOCL is to contain the following information:

a. ESTC Identification Serial—the DEOCL Number;

b. Classification Status;

c. Item Identification;

d. HD, Compatibility Group, Hazard Division Sub Division;

e. UN Number;

f. NEQ and TEQ; and

g. Package Data and Item quantity per pack.

Responsibilities

1.7 The Procurement Authority is responsible to ensure that appropriate classifications are allocated before the EO reaches an Australian port of entry and/or before the item enters service or is put to use. If a particular item is to be used by more than one element of the Department, the introducing sponsor is to ensure other interested parties are provided with the correct classification data.

1.8 The Department of Infrastructure, Transport, Cities and Regional Development is the Commonwealth Government Department responsible for administering the application of the UN System and provides the forum for Commonwealth intergovernmental and inter-departmental consultation. The department is also the authority responsible for liaison and consultation with the UN Group of Experts that provide advice on the transport of dangerous goods.

1.9 The Defence Science and Technology Group (DSTG) is to advise on explosive substance classification testing. The expertise of DSTG in this respect is available to the ESTC and all other elements of the Department.

1.10 Explosives Storage and Transport (EST) section of the Directorate of Ordnance Safety—Joint Logistics Command (DOS–JLC) is the point of contact with regard to matters relating to the classification of EO. The EST section is the Defence authority for allocating, changing and recording Hazard Classification Codes (HCC) for EO and is responsible for advising elements affected, of classifications allocated.

1.11 The EST section is responsible for confirming temporary classifications, allocating permanent classifications, determining the need for qualification and classification testing to be conducted by introducing sponsors and advising reclassification data.

1.12 The EST section has the following hazard classification specific responsibilities:

a. the provision of advice on temporary classifications upon the request of an introducing sponsor;

b. to confirm a temporary classification nominated by a sponsor;

c. to determine the need for qualification and classification tests required before a permanent classification may be allocated;

d. to provide advice on the conduct of qualification and classification tests and assistance in assessing test results;

e. to allocate permanent dangerous goods Class 1 classifications for Defence EO;

f. to forward, through the Department of Infrastructure, Transport, Cities and Regional Development, submissions to the UN for permanent classification of explosive substances; and

g. to maintain the DEOCL database in the format prescribed in paragraph 1.6.

h. conduct a 5 yearly review of hazard classifications.

Procedures

1.13 Procedures are required for the classification of Department of Defence owned or controlled explosives, recording and amending data as necessary, and disseminating the information within Defence. The following procedures are relevant to hazard classification of Defence EO;

a. Procedure 1 – Hazard Classification of Explosives.

b. Form GI-039 Application for a Defence Explosive Ordnance Classification Listing

Annex:

A. Hazard Classification of Defence Explosives

PROCEDURE 1 - HAZARD CLASSIFICATION OF EXPLOSIVES

Introduction

1.1 In 1981 Defence adopted the United Nations Systems of Classification for Dangerous Goods Class 1 (Explosives) and the NATO Safety Principles for the storage, transport and handling of Defence explosive ordnance (EO).

Purpose

1.2 This procedure provides for Department of Defence Explosives Regulations, Regulation 2.1 – Hazard Classification.

1.3 Hazard Classification of Defence EO being introduced into service is to be undertaken in conjunction with the requirements of DEOP 102 - *Technical Integrity of Explosive Ordnance,* Part 3, Chapter 4 – Certification for Storage and Transport.

Applicability

1.4 These procedures are applicable to the Commonwealth explosives determined to be Defence EO. Defence EO is classified into Hazard Divisions and Compatibility Groups for transport, storage and handling purposes in accordance with the hazard classification system that is described in Annex A to Regulation 2.1.

1.5 When certain items containing explosives are considered to be non-hazardous they may be excluded from the classification system and also from the list of Defence EO in Topic -025 of the item publication. This occurs when the quantity of explosive present in a device is either so small or so situated that if the explosive functions inadvertently or accidentally the effects external to the device either by projection, fire, smoke, heat or loud noise do not constitute a danger to persons handling the device. Such items are not to be stored within an EO building unless they are components of a weapon or weapon assembly.

1.6 There are a number of items in the Defence inventory that are related by function to explosives and which are used for somewhat similar purposes as certain types of explosives, or are components of weapon systems. These items are classified as 'Non-explosive Dangerous Goods' (NEDG). NEDG are by their nature hazardous and are classified as Dangerous Goods within Classes 2 to 9, as appropriate. In the Service environment NEDG may be managed as if they belong to Dangerous Goods Class 1, ie they are allocated a Hazard Classification Code (HCC) for storage and transportation purposes and may be stored and handled in EO storage areas in accordance with the specific instructions for NEDG given in Procedure 1 of Regulation 4.3.

1.7 All Defence EO is listed in item publications which include essential information for packaging, storage, handling, loading and transportation of that item of EO, associated non-explosive components and some radioactive materials. Specific packaging information is found in the Topic -025. The NEDG referred to in paragraph 1.8 are also included in the Topic -025. HCC listed in the Topic -025s are sourced from the Defence Explosive Ordnance Classification Listing (DEOCL).

Nomenclature for Movements

1.8 When EO and NEDG are to be moved by rail, road, air or sea the Proper Shipping Name for items given in Topic -025 of the item publication is to be used on the Shipper's Declaration for Dangerous Goods to identify the items being transported.

Procedures

1.9 **New items of explosive ordnance.** It is the responsibility of the Procurement Authority to ensure that appropriate classifications are allocated before the item reaches an Australian port of entry and/or before the item enters service or is put to use[1]. If a particular item is to be used by more than one element of the Department, the introducing sponsor is to ensure other interested parties are provided with the correct classification data. The introducing sponsor is to:

a. determine whether the manufacturer or supplier has conducted hazard classification trials in accordance with UN publication Recommendations on the Transport of Dangerous Goods – Manual of Tests and Criteria ST/SG/AC.10/11. If so, the sponsor is to obtain the details of any results obtained and have Form GI-039—*Application for a Defence Explosive Ordnance Classification Listing* (DEOCL)(1), completed. If results are not available, the sponsor may have to arrange separate trials. Form GI 039 is available on Web Forms;

b. nominate a temporary Hazard Division (HD), compatibility group and UN number and notify the ESTC of this temporary classification using Form GI 039—*Application for a Defence Explosive Ordnance Classification Listing* (DEOCL) (1). The ESTC will confirm the suitability of any temporary classification pending allocation of a permanent classification. The temporary classification may be used for transport and storage purposes unless advised to the contrary by the ESTC. Note that a temporary classification may be allocated to an experimental or trial item for which there is no intention to apply for a permanent classification. This should be made clear when advising the ESTC of the temporary classification nominated. Temporary classifications are generally valid for a maximum of two years unless re-approved by the ESTC;

c. request the ESTC to determine a permanent classification; and

d. administer and conduct any qualification or classification tests required by the ESTC.

1.10 New explosive substances. Requests for the classification of new explosive substances for transportation are to be referred to the ESTC which may then pass the request directly to DSTO for the recommendation of a temporary classification to the ESTC, pending conduct of appropriate qualification and classification tests. For high explosives type substances a default HD 1.1 classification will normally be allocated unless specific test data is provided for the package proposed. For other types, eg propellants or pyrotechnics, care must be taken to ensure that the proposed packaging does not cause a more severe event on initiation than that normally expected if the material were ignited unconfined. Following its acceptance of the temporary classification, the ESTC is to document the details and any restrictions allocated in the DEOCL. Where necessary, the ESTC is to seek, through the Department of Infrastructure and Transport, permanent classifications for incorporation into the UN system.

1.11 Reclassification. The hazard classification of an item must be reviewed when a modification has been effected which is recognised as being significant by the ESTC or the sponsoring agency. Sponsors are to request a reclassification review using Form GI-039 - Application for a Defence Explosive Ordnance Classification Listing (DEOCL) (1) in the following circumstances:

a. a new explosive substance or a mixture of explosive substances are introduced which are considered significantly different from other mixtures which are already classified;

b. a new design of article or an existing article containing a new explosive substance or mixture of explosive substances is introduced;

c. a component of a complete article is reclassified which may require a change to the classification of the parent article;

[1] Applications for classification of Explosive Ordnance, using Form GI 039, require 30 days notification to allow for any subsequent investigation to be completed.

d. the introduction of a new design of package for an explosive article, including a new type of inner packaging (a relatively minor change in inner or outer packaging can be critical and may convert a single article risk into a mass explosion risk); or

e. the creation of a unit load unless all packages have an identical Hazard Classification Code (HCC). The resultant HCC should be applied to the unit load as a whole, treating it as if it were a package for the purposes of marking and labelling.

Review

1.12 All Hazard Classifications are to be reviewed after five years to ensure that the entry is still required and that circumstances relevant to the classification have not changed. DEOCL items subject to this five yearly review are to be reported back to the next ESTC meeting.

Defence explosive ordnance classification listing database

1.13 The DEOCL database is the primary EO classification listing maintained by Defence and has precedence over all other EO hazard classification listings unless advised to the contrary by Commander Joint Logistics (CJLOG) (after consultation with the ESTC) or the ESTC. Users are to advise the ESTC of suggested additions and changes as they occur.

1.14 The DEOCL database contains the following information:

a. ESTC Identification Serial—the DEOCL Number;

b. Classification Status—temporary, permanent or for visiting forces;

c. Sponsor Identifier which also indicates single Service management;

d. Item Identification—abbreviated as necessary;

e. HD, Compatibility Group and UN Number;

f. Supplementary Fire Symbol (if required);

g. net explosives quantity and transportation explosives quantity in kg per 1000 items for either a complete item or specified quantity;

h. Package Data and item quantity per pack;

i. International Maritime Dangerous Goods Code (if required); and

j. any other significant factor.

1.15 The DEOCL is an unclassified database and is freely available within Defence on the DOS Intranet site. External agencies requiring copies may request them from the ESTC.

1.16 The DEOCL Supplement is a restricted database that is available from the ESTC by request.

List of Authorised Commonwealth Explosives

1.17 The List of Authorised Commonwealth Explosives (LACE) is a generic listing of Commonwealth explosives. The LACE is available on the DOS Intranet and Internet site. The ETR prohibit the transport of unauthorised Commonwealth explosives.

Foreign Sources

1.18 The classifications of visiting forces ammunition by the respective National Competent Authorities are accepted by the ESTC. Lists of such ammunition should be sent to ESTC before shipment.

1.19 EO Hazard Classification information is available from the following sources by request through the ESTC:

a. The UK ESTC Classification Database (as amended) for items of UK origin and previously classified by UK authorities and advised therein.

Note

UK Health and Safety Executive classifications are not to be used.

b. The United States Department of Defense Safety Board (US DDESB) Joint Hazard Classification System—Ammunition and Explosives (as amended) for items of US origin previously classified by US authorities and advised therein.

Note

US Federal Logistics Information System classifications are not to be used.

ANNEX A

HAZARD CLASSIFICATION OF DEFENCE EXPLOSIVES

1. In 1981 the Department of Defence adopted the UN System for Classification of Dangerous Goods. Defence explosives safety policy is that all Explosive Ordnance (EO) be classified in accordance with the UN System prior to all modes of transport and prior to storage in Defence-owned or leased facilities.

Purpose

2. This annex describes the essential features of the UN system for the classification of explosives and the sub division specifically developed for storage and licensing for quantity distance determination.

HAZARD CLASSIFICATION

Hazard divisions—general

3. Once a substance or article is determined to belong to Class 1 (Explosives), the purpose of the hazard classification is to assign a hazard division (HD). Note that articles containing explosives substances in such quantity or of such a character that their inadvertent or accidental ignition or initiation during transport shall not cause any effect external to the device either by projection, fire, smoke or heat or loud noise are not required to be included in Class 1.

4. Class 1 (Explosives) is divided into six divisions. The first four of these indicate the main type of hazard anticipated in the event of an accident: blast (Division 1.1), projection effects (Division 1.2), fire and radiant heat (Division 1.3) and no significant hazard (Division 1.4). The other two divisions (Division 1.5 and Division 1.6) are substance or article specific and are discussed in paragraphs 13 and 14 respectively. It should be noted that 'no significant hazard' does not mean no hazard; the hazard is less significant than that associated with other hazard divisions but it still exists and must not be ignored.

5. This manual uses the term 'Hazard Division' instead of 'Division' to emphasise the hazardous nature of explosives and to avoid the cumbersome alternative 'Division 1 of class 1' etc. The purpose of using these hazard divisions is to simplify the task of making regulations for safe storage and transport and to facilitate the observance of such regulations by identifying packages or articles by a simple numerical code.

6. Class 1 is unique in that the type of packaging occasionally has a decisive effect on the hazard and therefore on the assignment of a particular HD[1]. If explosives packaging is changed, a request for UN reclassification is to be submitted—see Regulation 2.1 Procedure 1 paragraph 1.13.

Characteristics of hazard divisions

7. **HD 1.1.** HD 1.1 comprises explosive substances and articles that have a mass explosion hazard giving rise to blast and both high and low velocity projections. A mass explosion is one which affects almost the entire load virtually instantaneously. Such an explosion will result in severe structural damage, the severity and range being determined by the amount of high explosives involved. There is a risk of heavy debris being propelled from the structure in which the explosion occurs, or from the crater.

8. **HD 1.2.** HD 1.2 comprises explosive substances and articles which have a projection hazard but not a mass explosion hazard. An explosion will result in items burning and exploding progressively, a few at a time. Furthermore, fragments, firebrands and unexploded items may be projected in considerable numbers; some of these may explode on impact and cause fires or more

[1]An unpackaged Detonator may be classified as HD 1.1B. The same detonator can present hazards consistent with HD 1.4S when packaged in a particular configuration in specified packaging.

explosions. Blast effects are limited to the immediate vicinity. For the purpose of determining storage quantity distance a distinction, depending on the size and range of fragments, is made between those items which give small fragments of moderate range and those which give large fragments with considerable range. A method to determine this distinction is by Net Explosives Quantity (NEQ) of the individual items. The more hazardous items generally contain high explosives and have an individual NEQ of greater than 0.73 kg and the less hazardous items an individual NEQ of 0.73 kg or below[2]. Another method to determine the distinction between more and less hazardous items was used previously but is no longer recognised by the North Atlantic Treaty Organisation (NATO). This method was based on projectiles and cartridges less than 60 mm being assigned to the less hazardous, while those above 60 mm to the more hazardous.

9. **Subdivisions for storage.** The HD 1.2 subdivisions 1.2.1 and 1.2.2 are for storage purposes only and it is stressed that it is not a recognised code in the United Nations (UN) system of classification and must not appear on package labelling. If comprehensive data is available for a particular item, then the item may be placed in that category of HD 1.2 supported by the data and allocated the relevant QD. It may be necessary to take into account the vulnerability of items and the buildings in which they are stored at the Exposed Site (ES) under consideration.

a. **Items classified HD 1.2.1.** The more hazardous part of HD 1.2 ie HD 1.2.1 comprises those munitions that contain a high explosive charge and may also contain a propelling or pyrotechnic charge. These items will have an individual NEQ greater than 0.73kg.

b. **Items classified HD 1.2.2.** The less hazardous part of HD 1.2 comprises those munitions that contain a high explosive charge and may also contain a propelling or pyrotechnic charge. These munitions will have an individual NEQ equal to or less than 0.73kg. It will also typically include ammunition that does not include high explosive and will include pyrotechnic rounds and articles and rounds with inert projectiles. Tests show that items of HD 1.2.2 produce fragments and lobbed EO with a range significantly greater than that of EO in HD 1.4. but less than those of HD 1.2.1.

c. **Items classified as HD 1.**2.3. A special storage subdivision with its own unique set of quantity distances which is applicable to EO that exhibit at most an explosion reaction in sympathetic reaction testing per STANAG 4396 and a burning reaction in bullet impact, slow heating, and liquid fuel/external bonfire testing per STANAGs 4241, 4382 and 4240, respectively.

10. **HD 1.3.** HD 1.3 comprises explosive substances and articles which have a fire hazard and either a minor blast hazard or minor projection hazard or both, but not a mass explosion hazard. It includes some items which burn with great violence and intense heat emitting considerable thermal radiation (mass fire hazard) and others which burn sporadically. For the purpose of determining storage quantity distance a distinction is made between those items. Items in this division may explode but do not usually form dangerous fragments. Firebrands and burning containers may be projected. (see Regulation 5.4 Procedure 1, paragraphs 1.16-1.19).

11. It is stressed that HD 1.3.3 and HD 1.3.4 are not recognised codes in the UN system of classification and are to be used only for storage purposes and must not appear on package labelling. A distinction is made between the more hazardous items (HD 1.3.3) and those of lesser hazard (HD 1.3.4).

a. **Items classified Hazard Division 1.3.3 producing a mass fire effect.** HD 1.3.3 consists of the more hazardous items of HD 1.3 and are more likely to be bulk packed gun propellants which produce a fireball with intense radiant heat, firebrands and some fragments. The firebrands may be only small glowing particles of packaging materials but sometimes there may be massive fiery chunks of burning propellant. The effect of quite normal winds may augment a calculated flame radius by 50 per cent. A

[2] It is important not to exaggerate the significance of the value 0.73 kg. It has been derived from a specific break point in the database supporting the quantity distance relationships and tables, and the NEQ of the items trialled (see Regulation 5.4 Procedure 1, paragraphs 1.13-1.15)

building with marked asymmetry of construction, such as an igloo, or a building with protective roof and walls, but with one relatively weak wall or a door induces very directional effects from the flames and the projection or burning packages. These effects are particularly significant for storehouses and process buildings at the ES facing the directional jetting. If prompt attendance by a fire brigade is impossible, loss of such buildings and contents may occur. Wherever possible, a PES should always vent away from an ES otherwise an increased risk of propagation of fire exists.

b. **Items classified Hazard Division 1.3.4 not producing a mass fire effect.** HD 1.3.4 consists of the less hazardous items of HD 1.3 that produce a moderate fire with moderate projections and firebrands. The projections include fragments that are less hazardous than those which characterise HD 1.2 as described in paragraph 1.8.

12. **HD 1.4.** HD 1.4 comprises explosive substances and articles which present no significant hazard (compared with the HD described above) and which present a small hazard in the event of ignition or initiation during storage or transport. The effects are largely confined to the package and no projection of fragments of appreciable size or range is to be expected. An external fire does not cause the instantaneous explosion of the entire contents of a package of such items. Some but not all substances and articles of this division are assigned to Compatibility Group S. Those items assigned to Compatibility Group S are so packaged or designed that any hazardous effects arising from accidental functioning are confined within the package unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder firefighting or other emergency response efforts in the immediate vicinity of the package.

13. **HD 1.5.** HD 1.5 comprises very insensitive substances which have a mass explosion hazard but that are so insensitive that there is very little probably of initiation or of transition from burning to detonation under normal conditions of storage and transport. Note that the probability of transition from burning to detonation is greater when large quantities are carried eg in a ship’s hold. For storage purposes, such substances are treated as HD 1.1 since, if an explosion should occur, the hazard is the same as for items formally assigned to HD 1.1, ie blast.

14. **HD 1.6.** HD 1.6 comprises extremely insensitive articles which do not have a mass explosion hazard. Such articles contain only extremely insensitive detonating substances and demonstrate a negligible probability of accidental initiation or propagation. The risk from articles of HD 1.6 is limited to the explosion of a single article. Therefore, the effects of single item initiation should be used to determine storage requirements. Articles containing only extremely insensitive detonating substances belong to Compatibility Group N (see paragraph 27).

Classifications for explosive ordnance—special cases

15. **Inert EO.** EO which does not contain any explosive or other dangerous goods (for instance dummy bombs, cartridges and projectiles) is excluded from the UN system of hazard classification.

16. **Toxic EO.** EO containing an explosive dispersing or propelling charge and a toxic chemical agent is assigned to the appropriate HD on the basis of explosive hazard. Such items are to be assigned to an appropriate HD and Compatibility Group K—see paragraph 27. A subsidiary risk label is to be used on the package—see paragraph 20

17. **Pyrotechnic EO.** Chemical EO containing tear gas, a corrosive agent, white phosphorus, napalm etc without explosives is assigned to the appropriate dangerous goods class (6, 8 etc) of the UN System for transport. For storage purposes in an explosives depot, such items may be assigned to HD 1.3 or HD 1.4 as appropriate and a compatibility group allocated. Such EO with an explosive dispersing or propelling charge is assigned to the appropriate HD on the basis of the explosive hazard and a compatibility group allocated.

18. **Depleted Uranium (DU) EO.** EO containing DU is not permitted to be stored, transported or handled in Australia. DU would present in the form of a penetrator or projectile and would be assigned to the hazard classification appropriate to the explosives content of the EO only. Due to the slight radioactivity and chemical toxicity of DU, special storage and transport provisions are required.

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19. Dangerous goods Class 9. Some appliances, eg UN No 2990—Life-saving Appliances, Self-inflating and UN No 3072—Life-saving Appliances, Non Self-inflating, are classified under Class 9 (Miscellaneous Dangerous Substances and Articles). The UN No 2990 appliances present a hazard if the self-inflating device is activated accidentally, however, both UN No 2990 and 3072 appliances may also include one or more of the following dangerous goods as equipment: signal devices (Class 1); non-flammable, non-toxic gases (Division 2.2); small quantities of flammable substances (Classes 3, 4.1 and 5.2); electrical storage batteries (Class 8); lithium batteries (Class 9); and small quantities of corrosive solids. Accordingly, all Class 9 appliances which contain Class 1 (explosive) components should be handled and stored on the basis of the classification of the explosive components in an explosives storage area, but should not be stored with other EO in quantity. The items may be stored outside an explosive storage area as Class 9 as long as the items are stored and handled as complete items and the life rafts are not opened, thereby exposing the EO. Serviceability and lifing of explosive components in Class 9 appliances must be monitored through the normal EO surveillance programs.

20. Subsidiary risk. Some items of EO may exhibit characteristics of more than one dangerous goods class eg explosives and poisons. For EO, the primary classification will always be Class 1 with, in this example, a subsidiary risk classification of Class 6.

21. Classification of unit loads. Unit loads or transport units which contain EO of mixed Compatibility Groups C, D and E and mixed HD eg 1.1D, 1.2D and 1.3C, must be allocated an overall hazard classification code for the unit load or transport unit. The appropriate HD 1 through 6 and compatibility group is determined by applying the mixing rules contained in Regulation 3.2 Procedure 1 —'Mixing Rules for Transport'.

STORAGE AND TRANSPORT COMPATIBILITY

General principles

22. EO is considered to be compatible if it may be stored or transported together without significantly increasing either the probability of an accident or, for a given quantity, the magnitude and effects of such an accident.

23. EO should not to be stored or transported together with other dangerous goods which could add additional hazards: eg highly flammable materials, acids, corrosives.

24. The safety of EO in storage or transport would be more certainly ensured if each hazard classification was kept separate, but this ideal practice is not always practicable. A proper balance of the interests of safety against other factors requires the mixing of various hazard classifications of EO during storage and transport.

Formulation of compatibility groups

25. To simplify the activity of mixing EO during transport and in storage EO is assigned to compatibility groups on the basis of the principles in paragraphs 22–24.

26. EO is formally grouped into thirteen compatibility groups: A to H, J, K, L, N and S. Group I is omitted to avoid confusion between the letter 'I' and the Roman numeral 'I'. Group S is distinctive since it is an indicator of unique possibilities for mixing in storage and transport.

Definitions of the compatibility groups and hazard classification codes

27. The definitions of the various compatibility groups, together with amplifying notes at paragraphs 27–32, follow:

a. **Group A:** primary explosive substance.

b. **Group B:** article containing a primary explosive substance and not containing two or more protective features.

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c. **Group C:** propellant explosive substance or other deflagrating explosive substance or article containing such explosive substance.

d. **Group D:** secondary detonating explosive substance or black powder or article containing a secondary detonating explosive substance, in each case without its own means of initiation and without a propelling charge, or article containing a primary explosive substance and containing two or more effective protective features.

e. **Group E:** article containing a secondary detonating explosive substance, without its own means of initiation, with a propelling charge (other than one containing a flammable liquid or gel or hypergolic liquids).

f. **Group F:** article containing a secondary detonating explosive substance with its own means of initiation, with a propelling charge (other than one containing a flammable liquid or gel or hypergolic liquid) or without a propelling charge.

g. **Group G:** pyrotechnic substance, or article containing a pyrotechnic substance, or article containing both an explosive substance and an illuminating, incendiary, tear or smoke producing substance (other than a water activated article or one containing white phosphorus, phosphides, a pyrophoric substance, a flammable liquid or gel, or hypergolic liquids).

h. **Group H:** article containing both an explosive substance and white phosphorus.

i. **Group J:** article containing both an explosive substance and a flammable liquid or gel.

j. **Group K:** article containing both an explosive substance and a toxic chemical agent.

k. **Group L:** explosive substance or article containing an explosive substance and presenting a special risk (eg due to water-activation or presence of hypergolic liquids, phosphides or pyrophoric substance) and needing isolation for each type.

l. **Group N:** articles which contain only extremely insensitive detonating substances and which demonstrate a negligible probability of accidental initiation or propagation.

m. **Group S:** substances or articles so packed or designed that any hazardous effects arising from accidental functioning are confined within the package unless the package has been degraded by fire, in which case all blast or projection effects are limited to the extent that they do not significantly hinder or prohibit firefighting or other emergency response efforts in the immediate vicinity of the package.

Notes on Compatibility Groups

28. **Compatibility Group D** applies only when secondary detonating explosive (high explosive) or black powder is properly packed in a dust-tight container. Otherwise, special precautions are essential and Compatibility Group L would apply.

29. **Compatibility Group D or E** may apply to EO which is fuzed or packed together with fuzes, if the fuzes are adequately protected. See the definitions of ‘with/without its (own) means of initiation’ in the Department of Defence Explosives Regulations —‘Glossary of Terms’.

30. **Compatibility Group F** does not necessarily apply to EO which is fuzed or packed together with fuzes, if the fuzes are adequately protected. See the definitions of ‘with/without its (own) means of initiation’ in the Department of Defence Explosives Regulations —‘Glossary of Terms’.

31. **Compatibility Group S** corresponds to safety ammunition which constitutes part of HD 1.4.

32. **Compatibility Group N** applies only to HD 1.6. The potential administrative advantage of Compatibility Group N EO will be lost when mixed with other HDs and/or compatibility groups.

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Determination of compatibility group

33. The compatibility group of EO is determined on the basis of the definitions given in paragraph 27.

CLASSIFICATION BY HAZARD DIVISION AND COMPATIBILITY GROUP

General

34. The following explains how the Hazard Classification Code (HCC) can be used to simplify:

a. The labelling of EO,

b. The entries in storage and transport documents, and

c. The formulation of safety instructions.

Hazard classification code

35. A HCC is composed of the HD designation (eg '1.1') and the assigned compatibility group letter (eg 'B'), to give in this example, '1.1 B'. The simple alphanumeric code indicates the hazard present and degree of compatibility for storage and transport.

36. Table 1A–1 lists the possible combinations of HDs and compatibility groups, ie HCC for EO.

Number of hazard classification codes

37. Table 1A–1 lists only 35 HCC although at first sight the six HD and 13 compatibility groups should give many more combinations. Some combinations cannot exist because the definitions of the Division and the Group are mutually exclusive, or do not occur in practice because the resultant characteristics are highly improbable or useless for EO.

Classification assessment

38. In practice, the compatibility group is assigned first, and the HD is assigned next, as shown in table 1A–1. This table summarises the relevant characteristics of the whole range of EO in terms of the HCC.

39. Where there is doubt about the interpretation of the definition of the compatibility groups, it may be helpful to consult the list of classifications of existing types of EO. Compatibility Group S is exceptional, in that testing or other assessment of the effect of explosion in the article or package is a prerequisite for assignment to this Group.

40. Table 1A–1 shows that usually an article or package complying with the definition of a particular compatibility group can have alternative HCC dependent upon the hazard assessment. The hazard assessment depends on the nature and quantity of explosive substance, the type of packaging and other factors and thus cannot always be determined by theoretical methods.

41. Although it is helpful to predict the effect of explosion by reference to the entries for similar EO, undue reliance on such an expedient can be dangerously misleading. An apparently minor difference in construction or packaging can be critical and make a significant difference to the effect of explosion, thus necessitating a change in the hazard assessment and HCC. It is for this reason that there is great importance attached to actual tests.

Use of hazard classification codes

42. HCC are very useful because they are so concise and present no language problems. The 35 HCC shown in table 1A–1 summarise the significant characteristics, for safe storage and transport, of the whole range of types of EO. These advantages can be exploited as follows:

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a. EO can be marked or labelled with HCC to facilitate identification. Various national systems have been used for many years. The objective is to use one system worldwide for both commercial and military explosives, and for the system to resemble that used for other dangerous goods. The codes of the International System of Classification are well suited to this aim.

b. Documents relating to storage and transport of EO can use HCC to convey the majority, and sometimes the whole, of the technical information needed to ensure safe handling, permitted mixed storage or stowage, required segregation, a suitable building or vehicle and appropriate fire fighting techniques.

c. Safety regulations for storage and transport of EO can be formulated more simply and concisely by framing them in terms of HCC. The codes have been selected so as to harmonise with the requirements of the various nations and individual modes of transport. Although the requirements may differ, the regulations can all use the same codes to promote standardisation of concepts and terminology.

Lists of explosives substances and articles

43. A comprehensive list of generic classifications together with specific classifications for explosives substances and articles in accordance with the UN International System of Classification are given in Explosives Storage and Transport Committee pamphlet No 2—*Defence Explosive Ordnance Classification Listing* (DEOCL).

44. The generic list of classifications includes the UN (Serial) Number, HCC and authorised short name as allocated by the UN system. The names in capital letters in the list constitute the authorised short name (Proper Shipping Name) of items for use on packages and in transport documents.

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Compatibility Group														
Hazard Division	A	B	C	D	E	F	G	H	J	K	L	N	S	A–S Σ
1.1	1.1A	1.1B	1.1C	1.1D	1.1E	1.1F	1.1G		1.1J		1.1L			9
1.2		1.2B	1.2C	1.2D	1.2E	1.2F	1.2G	1.2H	1.2J	1.2K	1.2L			10
1.3			1.3C			1.3F	1.3G	1.3H	1.3J	1.3K	1.3L			7
1.4		1.4B	1.4C	1.4D	1.4E	1.4F	1.4G						1.4S	7
1.5				1.5D										1
1.6												1.6N		1
1.1–1.6 Σ	1	3	4	4	3	4	4	2	3	2	3	1	1	35

Table 1A-1: Combination of hazard divisions and compatibility groups

REGULATION 2.2 - NET EXPLOSIVE QUANTITY

General Overview

2.1 The determination of the Net Explosive Quantity (NEQ) and Transport Explosive Quantity (TEQ) is a necessary and important part of the assessment of the hazards induced by a single item of Explosive Ordnance (EO) or a set of them as in a unit load or transport or storage unit.

Requirements

2.2 All Defence EO is to have the NEQ and TEQ determined prior to all modes of transport and prior to storage in Defence-owned or leased facilities.

2.3 NEQ and TEQ are to be promulgated at least quarterly via the Defence Explosive Ordnance Classification Listing (DEOCL).

Responsibilities

2.4 The Procurement Authority is responsible to ensure that the NEQ and TEQ are determined before the EO reaches an Australian port of entry and/or before the item enters service or is put to use. If a particular item is to be used by more than one element of the Department, the introducing sponsor is to ensure other interested parties are provided with the correct NEQ.

2.5 The Explosives Storage and Transport Committee is responsible to maintain the DEOCL.

Procedures

2.6 Procedures to implement this regulation are found in Procedure 1 – Determination of Net Explosive Quantity and Transport Explosives Quantity.

PROCEDURE 1 - DETERMINATION OF NET EXPLOSIVE QUANTITY AND TRANSPORT EXPLOSIVE QUANTITY

Purpose

1.1 This procedure provides the requirements for implementing Department of Defence Explosives Regulations, Regulation 2.2 –Net Explosives Quantity.

Rules for Determining Net Explosive Quantity of a Single Item of EO

1.2 The Net Explosive Quantity (NEQ) of a single item of Explosive Ordnance (EO) is the Transport Explosive Quantity (TEQ) of the EO unless it has been determined, e.g. by testing, that the explosive effects of the EO significantly differ from the explosive effects expected from that quantity.

Rules for Determining Net Explosives Quantity of a Set of EO Items

1.3 **Set of identical EO.** The NEQ of a set of identical items of EO, e.g. unit load, is obtained by adding together the NEQ of each item of EO, unless it has been determined, e.g. by testing, that the explosive effects of the set significantly differ from the explosive effects expected from that quantity.

1.4 **Set of EO of different classifications.** The NEQ of a set of items of EO of different classifications, e.g. storage unit, depends on the classification of the EO. The mixing rules for hazard divisions and compatibility groups are given in Regulation 3.2 Procedure 1 – Mixing Rules for Transport and Regulation 4.2 Procedure 1 – Mixing Rules for Storage. Determination of the NEQ is then obtained as explained in paragraph 1.3.

Explosive Quantity for Packaging Purposes

1.5 The NEQ figure to be placed upon an EO package when it is being packed or repacked is the actual NEQ as determined from the Explosives Storage and Transport Committee Pamphlet No. 2 – Defence Explosive Ordnance Classification Listing (DEOCL). The NEQ should be displayed to 3 decimal places. Where the NEQ marked on the EO package is below the published packaged NEQ in the DEOCL, the item is deemed to be serviceable. If the NEQ listed in the DEOCL has no decimal places, then there is no requirement to display the NEQ value to three decimal places (e.g. 105 kg not 105.000 kg). If the NEQ listed in the DEOCL has fewer than three decimal places, there is no requirement to display the NEQ to three decimal places (e.g. 1.8 kg not 1.800 kg). EO packages that contain less than 0.001 kg NEQ amounts are to be rounded up to three decimal places (e.g. 0.0005 kg rounded up to 0.001 kg).

1.6 Under no circumstances are NEQ calculations to be rounded down.

1.7 Where variation exists between the package and the DEOCL, it must be reported to the Explosive Materiel Branch (EMB) within the Capability, Acquisition and Sustainment Group (CASG) via Form EO 100 in accordance with Regulation 1.5 Procedure 1 Annex D.

Explosive Quantity for Storage Purposes

1.8 For the purpose of storage, it is necessary to determine the amount of explosive substance to use for computing Quantity Distances (QD). Therefore, this amount, referred to as the NEQ, must be expressed in such a way that it is possible to use the QD tables to determine the distances required.

1.9 The QD tables give the minimum distances between a Potential Explosion Site (PES) and an Exposed Site (ES). These are necessary to determine whether an acceptable risk exists in case of an explosion for persons and materiel assets that would be exposed. For instance, they give the minimum distance to inhabited buildings, or to public roads.

1.10 The QD tables have been determined by using data from accidents or tests where the PES was a charge in a certain configuration, called a reference charge e.g. a bare charge of TNT in case of

Hazard Division 1.1. Thus, the amount of explosive substance contained in the EO should be expressed in terms of equivalent charges whenever it is possible.

1.11 The NEQ of an item of EO is the amount 'Q' of the reference charge, expressed in kg, which, if replacing the EO, is supposed to have the same effects, in terms of blast, fragment energy or thermal flux. Therefore, the NEQ is the amount of explosive to be used in the QD tables or formulae to determine the safety distances in case of an explosion (detonation, deflagration or combustion).

1.12 Where two or more PES are not separated by the appropriate inter-magazine distances, they are considered as a single site, and the aggregate NEQ is used for determining QD. If two or more hazard divisions are involved, the principles in Regulation 4.2 Procedure 1 – Mixing Rules for Storage apply.

1.13 The NEQ and TEQ do not include such substances as white phosphorus, war gases or smoke, incendiary compositions and fuel, unless these substances contribute significantly to the dominant hazard of the hazard division concerned, e.g. Otto Fuel II in Mk 48 Torpedoes.

Explosives Quantity for Transport Purposes

1.14 For the purpose of transport the explosives quantity is regarded to be the total net mass, in kg, of explosive substances or, in the case of explosive articles, the total mass of explosive substances contained in all articles. In this instance the total explosives quantity is referred to as the TEQ. This is the 'Net Explosives Quantity' referred to in the AE Code (as revised).

REGULATION 2.3 - PACKAGING AND MARKING

General Overview

3.1 Explosive Ordnance (EO) and associated components are packed for transport, storage and handling in packages designed to minimise danger, damage and deterioration; such packages are normally to be used only for the purpose for which they were designed. However, in order to make effective use of stocks of empty packages many will be re-used to package items for which the package was not originally designed. The hazards arising from failure of packages that are filled with EO are serious. In addition to the danger to life, if a package fails it may necessitate costly inspection, repacking, renovation or destruction of the stores. It is therefore essential that the responsible authority ensures that EO packages meet certain design, construction and testing requirements prior to introduction into service.

3.2 Packaging is essential to maintain the safety, serviceability and reliability of EO by providing protection while in store and during transportation and handling. During most of its service life EO is in storage, protected from shock, vibration, and to some extent climatic conditions. When required by the user, EO may be transported by any available means, stored in exposed positions and subjected to a wide spectrum of environmental hazards. Finally, when required for use, the EO has to be quickly identified and then speedily removed from its package, often at night and in adverse conditions.

3.3 Prior to the introduction of a new package design into service, the approving authority is required to be satisfied that the package will perform satisfactorily during its service life. The standard of the empty package is to virtually guarantee that the contents will be serviceable when required for use after normal service handling.

3.4 Packages may have to be stored, transported and used in widely different conditions yet continue to comply with service operational requirements. To assist the approving authority in introducing a suitable package into service, it is necessary to test the package in appropriate environments and mechanical conditions to ensure that these requirements are achieved.

Requirements

3.5 **Marking of Explosive Ordnance.** Explosive ordnance will be marked in accordance with the requirements contained within this regulation and its associated procedures to provide ready identification of EO. UK Defence Standard (DEF STAN) 00-810 – Marking of Ammunition and Associated Packages and NATO standard AOP-2 – Identification of Ammunition may be used as a guide.

3.6 **Development of Packaging.** Prior to development of a new package, the design authority must seek advice from the user on the environment in which the subject EO will be used. This will determine what tests, stipulated in DEF STAN 00-35[1], the package will be subjected to during acceptance into service trials, eg operational ammunition, with a design life of 15 years, will require a higher standard of packaging than training ammunition, with a design life of eight years.

3.7 Packaging for EO should:

a. meet the user requirements and suit the operational role envisaged for the EO;

b. provide adequate protection for the contents against damage and loss of functional efficiency throughout its designed service life;

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[1] MODUK DEFSTAN 00-035 superseded DEFSTAN 00-35 and consists of five parts ie:

- Part 1 Environmental Handbook for Defence Materiel Part 1 - Control and Management
- Part 2 Environmental Handbook for Defence Materiel Environmental Trials Programme Derivation and Assessment Methodologies
- Part 3 Environmental Handbook for Defence Materiel Environmental Test Methods
- Part 4 Environmental Handbook for Defence Materiel Part 4 – Natural Environments
- Part 5 Environmental Handbook for Defence Materiel Part 5 - Mechanical Environments

c. be suitable for safe and economic transportation, storage and mechanical/manual handling;

d. have dimension, mass and costs which are as small as practicable;

e. have simple secure fastenings, capable of easy opening and re-closing, preferably nails are not to be used; and

f. carry identification markings which are not easily obliterated.

3.8 In addition to the requirements below and unless specific provision to the contrary is made, the packagings used for explosives must comply with at least the requirements for solids or liquids (as appropriate) of Packing Group II (medium danger).

3.9 **Packaging Design Standard and Testing.** Packaging design, or changes to packaging methods for EO are to be in accordance with the ST/SG/AC.10.1 - United Nations Publication Recommendations on the Transport of Dangerous Goods - Model Regulations (Orange Book) and Recommendations on the Transport of Dangerous Goods - Manual of Tests and Criteria (Orange Book Test Manual) and the AE Code.

3.10 In accordance with the AE Code, packaging used for explosives must meet the construction and performance requirements of the Australian Dangerous Goods (ADG) Code noting the general requirements of Chapter 4 of the ADG Code, in that:

a. they must be packed in good quality packagings, including Intermediate Bulk Containers (IBCs) and large packagings, which must be strong enough to withstand the shocks and loadings normally encountered during transport, including trans-shipment between cargo transport units, and between cargo transport units and warehouses, as well as any removal from a pallet or overpack for subsequent manual or mechanical handling;

b. packagings, including IBCs and large packagings, must be constructed and closed so as to prevent any loss of contents when prepared for transport, which may be caused under normal conditions of transport, by vibration, or by changes in temperature, humidity or pressure; and

c. packagings, including IBCs and large packagings, must be closed in accordance with the information provided by the manufacturer. No dangerous residue must adhere to the outside of packages, IBCs and large packagings during transport.

3.11 **Refurbishment of Packaging.** The minimum standard to which packages are to be refurbished is detailed in NOID Spec 52271 *Repair for Explosive Ordnance Packages*.

3.12 **Paint.** All package finishes are to be free of hazardous materials such as Zinc Chromate, Polyurethane (PUP) or Lead based paint and packages are to be free of any foreign materials.

3.13 **Plastic Packaging.** Plastic packaging is not to be introduced unless:

a. all appropriate tests outlined in the Australian Dangerous Goods (ADG) Code have been successfully completed;

b. the package is not susceptible to Ultra Violet (UV) degradation;

c. the package is not liable to the build-up of electrostatic charge that could initiate Electro-Explosive Device (EED) or exposed high explosive, propellant and pyrotechnic substances;

d. the package’s products of combustion do not present an unacceptable hazard to transport operations; and

e. a formal Safety and Suitability for Service (S3) assessment has been conducted on the package and its contents.

3.14 Packaging Instructions. The Packaging Instructions described in the AE Code must be used for each item of EO, and be listed in the Topic - 025 of the item publication. Accordingly, all new packages and any re-packaging proposals must meet the requirements of the AE Code.

3.15 Hazard Classification. Hazard classification is to be sought as soon as the package design is approved. When classification is obtained it takes into account the effect of the package on the EO that it contains. Hence, if the package requires to be changed or modified, a new classification may be required, which may require Hazard Classification Code testing in accordance with the Recommendations on the Transport of Dangerous Goods - *Manual of Tests and Criteria* (Orange Book Test Manual).

3.16 Packaging Marking. EO manufactured in Australia either to an Australian design or to a design originated in another country is to be marked in accordance with the requirements of the AE Code and the approved marking drawing for the EO developed in accordance with paragraph 3.8 design requirements. Exception to these requirements may be applicable for EO sourced from foreign sources.

3.17 Packaging for EED. Packaging for Electro-Explosive Device (EED) must not include the use of ordinary non-conducting polythene as a packaging material. EEDs when so packaged, are susceptible to initiation by the static charges which could be developed on the packaging material. Conductive polythene, ie that which contains 35 per cent carbon black or is otherwise made conductive by metallisation, may be used but metallised polythene is only to be used where there is no possibility of fracture of the metallic surface eg where constant flexing of the polythene will not occur. Exceptionally, non-conducting polythene may be used to package EED which, as packaged, are sufficiently screened and shielded by their construction or the use of shielding or shorting caps so as to be immune from the effects of any static charge which may develop on the packaging material. The type of polythene, conducting or non-conducting is to be specified in the packaging drawing or other instruction. Specialist advice relating to packages for EED is available from the Explosive Materiel Branch (EMB), Capability Acquisition and Sustainment Group (CASG).

3.18 Packaging materials. The choice of materials for packages for components will depend on the type of EO and the degree of protection required. The materials used are to be compatible with the material from which the EO is made, or with which it is protected, or alternatively, a suitable inner package is to be provided. All packaging materials are to be:

a. Free from any Asbestos containing materials;

b. Compliant with schedule 10 of the Work Health and Safety Regulations (2011) regarding prohibited carcinogens, restricted carcinogens and restricted hazardous chemicals; and

c. Where applicable should be International Standards for Phytosanitary Measures (ISPM) 15 compliant.

3.19 Packing and Unpacking. Procedures must be developed to provide for precautions to be observed for the packing and unpacking of explosive ordnance.

3.20 Closing and Sealing of Packages. Procedures must be developed for the closing and sealing of packing containing explosive ordnance to:

a. Detect tampering;

b. Signify that the contents are correctly described by the data shown on the outside of the packaging/unit load; and

c. Prevent the ingress of water or moisture laden air for applicable EO.

3.21 Monograms. The *Explosives Transport Regulations 2002 Statutory Rules No. 92, 2002* (ETR) requires the Department of Defence to have a means of identifying an establishment or organisation responsible for correct packaging of EO. To implement this requirement, the use of seals for sealing of packages in accordance with paragraph 3.16 will bear a station, unit or establishment monogram.

3.22 Packages Emptied of Explosive Ordnance. Procedures will be developed for the inspection, sealing and certification of packages as Free From Explosives (FFE) for the:

a. Transport of packaging which has contained EO, which must be in accordance with the ETR until it has been certified to be FFE material. This requirement is not applicable to the transport of newly manufactured packages that have not been put to use, nor to packages that have been refurbished and are yet to be filled and marked; and

b. Storage of packages that have been certified as FFE which will;

(1) be stacked separately from those packages which have not been so certified; and

(2) not be stored in an EO building together with EO without the written authority of the Officer-In-Charge.

3.23 Functioned EO for Salvage or Return. Functioned EO for salvage or return will undergo Inspection, Packaging and Certification to identify that a package contains an item that is FFE or safe for transportation.

3.24 Unit loads and freight containers. Unit load and freight containers are to be prepared and marked in accordance with the AE Code. For shipment by commercial Air or Maritime assets, the relevant Competent Authority document e.g. International Air Transport Association (IATA), International Maritime Dangerous Goods (IMDG) is to be referenced.

Responsibilities

3.25 The EO procurement agency is responsible for ensuring that:

a. empty packages of new manufacture conform to the requirements for design, construction, testing and marking;

b. empty and filled packages are subjected to adequate environmental and mechanical testing during acceptance into service trials;

c. additional evaluation, eg hazard classification, is undertaken as required; and

d. new packaging methods utilising currently-in-use packages are evaluated and formally authorised.

3.26 The following agencies are approved to conduct EO packaging tests in accordance with the requirements of paragraph 3.9-10:

a. a testing laboratory registered by the National Association of Testing Authorities (NATA) for the relevant packaging tests (the results are to be reported on a NATA endorsed test certificate);

b. a testing laboratory located overseas and recognised by the Directorate of Ordnance Safely (DOS); and

c. the following Defence agencies, provided tests are witnessed by the DOS or its delegate:

(1) Weapon and Combat Systems Division, DSTG Edinburgh and Maritime Division, DSTG Fishermans Bend;

(2) Land Engineering Agency; and

(3) Proof and Experimental Establishment, Port Wakefield.

3.27 The Explosives Storage and Transport Committee (ESTC);

a. May be referred to for additional evaluation of packaging. Acceptance of the ESTC final reports and recommendations rests with the approving authority.

b. Is responsible for the allocation and registration of monograms for use by Department of Defence establishments, Australian Munitions explosives factories, some Australian explosives manufacturers from whom Defence procures explosives, DSTG and Defence EO Service providers involved in the handling of EO.

Procedures

3.28 Procedures to implement this regulation are contained in:

a. Procedure 1 – Marking of Explosive Ordnance;

b. Procedure 2 – Packing and Unpacking of Explosive Ordnance;

c. Procedure 3 – Closing and Sealing of Packages;

d. Procedure 4 – Marking and Labelling of Explosive Ordnance Packages;

e. Procedure 5 – Handling of Packages Emptied of Explosive Ordnance;

f. Procedure 6 – Handling of Functioned Explosive Ordnance for Salvage and Return;

g. Procedure 7 – Unit Loads and Freight Containers.

PROCEDURE 1 - MARKING OF EXPLOSIVE ORDNANCE

Introduction

1.1 The marking system for Explosive Ordnance (EO) employs colour codes, lettering and symbols which are intended to provide ready identification of explosive loads and hazards presented by identified items. A colour coding system is employed to indicate the primary use of the EO, the presence of hazardous (explosive, flammable, irritant or toxic) filler and/or the colours of tracers, dye loads and signals. Lettering, sometimes in combination with symbols, is used to identify the nature of the store, the manufacturer, lotting and filling detail and any precautions for safe use.

1.2 The marking of EO is essential to ensure quick, correct and sufficient identification at all times. More specifically, markings are applied for the following reasons:

a. to provide all necessary details to assist inspection, to guard against the supply of faulty or unproved EO to users, to aid investigation into causes of faulty operation or defects and to trace suspect EO;

b. to facilitate the issue of correct nature and type of EO, to enable EO to be clearly and easily identified by the user under all conditions of service and to provide the user with the maximum information possible concerning the nature, type and function of the EO supplied; and

c. to provide sufficient information for storage, transport and other services to ensure that all EO is correctly stored, handled and transported according to the nature of the explosive.

1.3 Requirements for the marking and labelling of EO packages are detailed in Regulation 2.3 Procedure 4.

Purpose

1.4 This procedure prescribes the requirements and methods for marking of EO to facilitate correct identification for inspection, storage and transport purposes, and to meet the requirements of Regulation 2.3.

1.5 **Packaging Marking.** EO manufactured in Australia either to an Australian design or to a design originated in another country is to be marked in accordance with the requirements of the Australian Explosives Code for the Transport of Explosives by Road and Rail (AE Code) and the approved marking drawing for the EO developed in accordance with packaging design requirements. Exceptions to these requirements may be applicable for:

a. EO sourced from foreign Services is normally accepted bearing the markings applicable in the Service of origin. Similarly, there are occasions when stores of Australian or foreign propriety trade supply are accepted bearing their normal trade identification markings. These markings are normally retained for the life of the store or until such time as refurbishment is necessary. Depending on the nature and extent of the refurbishment, remarking may be undertaken at the same time. In such cases, the Explosive Materiel Branch (EMB) Drawing Office in association with the relevant Item Manager will issue a marking drawing in accordance Ministry of Defence (MOD) UK Defence Standard DEF STAN 00-810 Marking of Ammunition and Associated Packages, as a guide. Marking drawings are prepared by the EMB Drawing Office or authorised EO Services Provider on behalf of the relevant Item Manager, and approved by the delegated design officer for the Item Manager in question.

(1) **Note:** Since DEF STAN 00-810 is only an advisory document its distribution will be generally limited to staff who have a particular need for it. Due to this limited distribution and because all personnel who handle ammunition must know and be familiar with the DEF STAN 00-810 colour coding to identify the role or roles and hazards of ammunition, a summary of the colour coding is in Annex A.

b. There are, and will be, a number of items of EO for which the guidelines of DEF STAN 00-810 cannot be readily applied. In such circumstances the marking drawing will be prepared by the EMB Drawing Office or authorised EO Services Provider in consultation with the relevant Item Manager, and will employ the general principles of clarity, uniformity and simplicity.

Methods of Marking

1.6 **Permanent Markings.** Permanent markings are normally stamped, but they may be engraved, etched, embossed, moulded or applied by another approved process. They are normally used for marking manufacturing detail for empty components, but may also be employed for marking filling details and other information on small items such as fuzes and tracers. Embossing is generally used where night identification of a particular item is a service requirement.

1.7 **Non-permanent Markings.** Painting and stencilling are the processes normally used in the application of body colour, item identification and filling details, and other markings such as narrow bands, stripes and symbols to indicate special features. In certain circumstances, however, some or all of these markings may be applied by transfer, printing or by metal or plastic plates or tags, or stick on labels. In deciding which process is to be used for a particular nature, the durability of the markings and the environment in which the items are to be used are taken into account.

Specific Markings for Detonators

1.8 In accordance with the Australian Code for the Transport of Explosives by Road and Rail, Chapter 3, as from the year 2005, locally procured detonators for Commonwealth use are to be marked as follows:

a. The casing of every detonator of UN Numbers 0029, 0030, 0255, 0267, 0360, 0361, 0455, 0456 and 0500 is to be marked with the word ‘DETONATOR’.

b. The casing of every detonator not specified in sub-paragraph a, is to be marked with the words ‘BLASTING CAP’.

c. The casing of every detonator and every detonating relay is to be marked with the word ‘EXPLOSIVE’, together with the word ‘DANGEROUS’ and/or the word ‘DANGER’.

d. The words required by sub-paragraphs a, b and c are to be embossed or otherwise indelibly marked on the casing in upper case letters and be clearly legible.

1.9 The requirements of paragraph 1.8 will not apply to detonators procured from overseas for Commonwealth use.

UK/AUS Colour Equivalents for Painting and Marking of EO

1.10 A table of UK and Australian colour equivalents for the painting and marking of EO is given in Annex B.

Annex:
A. Colour Coding to Identify the Role(s) and Hazards of Ammunition
B. UK/AUS Colour Equivalents for the Marking of Explosive Ordnance

ANNEX A

COLOUR CODING TO IDENTIFY THE ROLE(S) AND HAZARDS OF AMMUNITION

Significant Colours

1. Significant colours are those used to indicate the primary role or roles of ammunition and the associated hazards. All references in these paragraphs to colours and tints are those prescribed in BS 381C.

2. Details of significant colour coding used for marking and identification of ammunition are detailed in Tables 1A-1 and 1A-2.

Non-Significant Colours

3. The following colours, although some are significant in relation to paragraph 2, when applied as stated below have no colour coding significance:

a. Grey, black, green or white on underwater ammunition.

b. Grey or white on guided missiles, dispensers and rockets.

c. Black or white used for lettering or numbering or special markings.

d. Colours specifically applied to identify the colour produced by smoke ammunition or pyrotechnics.

e. Unpainted or natural colour ammunition.

4. Except in cases of chemical ammunition, non-significant colours may be used as overall body colours to meet special requirements of the Service such as:

a. Deep bronze green No 224, this is the preferred dark green colour.

b. Infra-Red Reflective (IRR) NATO Green No 285, only to be used when specified by the relevant Item Manager.

c. Olive Drab, only to be used when specified by the relevant Item Manager.

d. Light aircraft grey No 627.

e. Dark admiralty grey No 632.

NATO Colour	Interpretation	UK Equivalent Colour (to BS 381C)
Yellow	HE ammunition or indicates the presence of a high explosive	Golden Yellow No 356
Brown	Low explosive items or components or indicates the presence of a low explosive	Middle Brown No 411
Grey	Ammunition containing a riot control, toxic chemical or incapacitating agent filler (see paragraph 3 for exceptions)	Light Grey No 631
Dark Red	Riot control agent filler	Cherry Red No 538
Dark Green	Toxic chemical agent (see paragraph 3 for exceptions)	Deep Chrome Green No 267 or Light Brunswick Green No 225
Dark Violet	Incapacitating agent filler	Dark Violet No 796
Black	Armour defeating ammunition or an armour defeating capability (see paragraph 3 for exceptions)	Black
Silver/ Aluminium	Countermeasure ammunition (radar echo, leaflets, etc)	Silver
Light Green	Screening or marking smoke ammunition	Eau-de-nil No 216
Light Red	Incendiary ammunition or indicates the presence of highly inflammable materials (liquids, gels, solids) designed to produce damage by fire	Signal Red No 537
White	Illuminating ammunition or ammunition producing a coloured light (see paragraph 3 for exceptions)	White
Light Blue	Practice ammunition used in place of combat equivalents	Deep Saxe Blue No 113
Dark Blue	Drill ammunition, with the exception of cartridges, charges and certain components	Oxford Blue No 105
Dark Violet	Experimental ammunition. Normally applied as longitudinal stripes superimposed on existing overall colour	Dark Violet No 796
Light Orange	Nuclear ammunition or indicates the presence of radioactive material	Light Orange No 557
Orange	Certain evaluation or training versions of guided missiles when photographic records are required. Normally applied as longitudinal stripes superimposed on existing overall colour	International Orange No 592
Pink	Certain acquisition training versions of guided missiles	Shell Pink No 453 Pale Roundel Red No 454

Table 1A–1: Ammunition 20mm and Above

NATO Colour	Role	UK Colour to BS 318C
Black	Armour Piercing	Black
Silver	Armour Piercing Incendiary	Silver
Blue	Incendiary	Light French Blue No 175
Yellow	Observing	Golden Yellow No 356
Red	Tracer	Cherry Red No 538
Uncoloured	Ball	Uncoloured

Table 1A–2: Ammunition Below 20mm

ANNEX B

UK/AUS COLOUR EQUIVALENTS FOR THE MARKING OF EXPLOSIVE ORDNANCE

1. The following table lists the commonly used colours by BS[1] 381C colour number and the equivalent AS[2] 2700 colour code. Reference may need to be made to AS 2700 if a more complete list of colour equivalents is required.

BS 381C Colour	Number	AS 2700 Colour	Code
Blue			
Light French Blue	175		
Deep Saxe Blue	113	Mountain Blue	Y51
Oxford Blue	105	Navy Blue	B13
Brown			
Middle Brown	411	Brown	X54
Service Brown	499	Chocolate	X64
Green			
Deep Chrome Green	267		
Light Brunswick Green	225	Moss Green	G14
Eau-de-nil	216	Palm Green	G44
Grey			
Light Grey	631	Storm Grey	N42
Orange			
Light Orange	557		
International Orange	592	International Orange	R11
Pink			
Shell Pink	453	Dusty Pink	P31
Red			
Post Office Red	538	Crimson	R15
Signal Red	537	Signal Red	R13
Yellow			
Golden Yellow	356	Golden Yellow	Y14

Table 1B–1: UK/AUS Colour Equivalents for the Painting and Marking of Explosive Ordnance

[1] British Standard

[2] Australian Standard

PROCEDURE 2 - PACKING AND UNPACKING OF EXPLOSIVE ORDNANCE

Introduction

2.1 This procedure prescribes the requirements for, and the precautions to be observed during, packing and unpacking of Explosive Ordnance (EO).

Packing of Explosive Ordnance

2.2 Unless otherwise stated herein, EO is to be packed in the package and in accordance with the method of packing specified in Item Publication, Topic -25 primarily, or the Defence Explosive Ordnance Classification List (DEOCL). Unless specified in either of these publications, the package and method of packaging are not authorised for use. If the approved package is not available or for any reason a change from the approved package becomes necessary, the proposed package and packaging method are to be approved by the delegated design officer for the Product Line in question. The process for obtaining approval from Explosive Materiel Branch (EMB) is detailed in Annex A. Personnel authorised to prepare proposals for new packaging methods are to base the design of such proposals on the requirements of Regulation 2.3.

Notes

> Packages supplied for re–use are to be in a serviceable condition, complete with all furniture for its intended use. Where applicable, package seals are to be fitted and active desiccant provided.

2.3 It is to be normal practice to store EO of the one lot number in a package. The exception to this is when residual small quantities of varying lots are consolidated into a single package. In this case lot numbers and corresponding quantities are to be separately marked on the outer package. Mixed lot packages that result over a period of time are to be re-consolidated into single lot packages at the earliest opportunity.

2.4 For purposes of transportation by commercial means, only the authorised package for the EO in question is to be used, and those stores that are normally packaged are not to be transported in a loose condition. In the event of an urgent shipment when the authorised packages are not available, details of the proposed alternative packaging are to be forwarded to the EMB for consideration. EO is not to be despatched until the proposed packaging method has been approved by the delegated design officer based on the recommendations of the EMB and any change to the hazard classification advised.

2.5 For purposes of temporary storage, EO received other than from normal sources of supply, e.g. that recovered from sunken vessels or surrendered by the public, may, when the use of the original package is not practicable, be placed in any suitable package provided the EO is secured when necessary by packing material, labelled to indicate the actual contents after obliterating all irrelevant markings, and the package is as near as possible to the original package description. The package is to bear the relevant Explosives Class Label. It is essential, to prevent deterioration of contents of the package, that the packing material is clean and dry. EO that is temporarily packaged is to be isolated from all other EO. It is to be re-packed into its authorised package as early as practicable after the EO has been inspected and sentenced safe for further storage.

Unpacking of Explosive Ordnance

2.6 On no account are packages containing EO to be opened for any purpose except as follows:

a. To use the item as intended

b. To make authorised issues or inspections

c. To verify the contents when the packages are received with broken or damaged seals; or

d. To carry out authorised repairs, assembly or modifications.

Conditions for Packing and Unpacking Explosive Ordnance

2.7 Packing and unpacking of EO is not to be conducted in an EO storehouse, except as permitted by Regulation 4.4 Procedure 2. Normally, packages are only to be opened in an EO workshop, EO preparation building or other area licensed as a preparation area.

Repacking of Commercially Packaged Explosive Ordnance

2.8 EO procured from a commercial supplier will normally be supplied in the standard retail trade package, the design and construction of which may change from time to time. This standard of packaging may be suitable for service use and consequently the effort and cost of repacking need not be incurred. However, repacking may still be required:

a. For operational stock requirements; or

b. When issues to establishments/units are in quantities less than the commercial pack (fraction pack).

2.9 The commercial package may only be used as a service package if it is authorised in Topic -25. If a commercial package is not so authorised but the receiving Depot, after due assessment in conjunction with the EMB Packaging Team, believes the package would be suitable as a service package, the Depot is to propose its use. Details of the package, packaging method and other relevant details are to be presented to the EMB Packaging Team, in accordance with Annex A.

Prevention of Deterioration of Explosive Ordnance

2.10 When EO is to be kept available for use at short notice, the following precautions are to be observed:

a. Belts, magazines, etc., filled Small Arms Ammunition (SAA) and other types of gun ammunition are to be packed in boxes which are to be made airtight and these are, where possible, to be kept in their appropriate storehouses.

b. Pyrotechnics that were originally packed in airtight packages are, at all times, to be stored under such conditions, except when about to be used for a specific operation. This also applies to those items that are stored in ready-use lockers. When transferring the contents of one airtight package to another, this is to be effected without delay and under the most favourable humidity control and conditions.

c. After removal from an airtight package for an operation that involves exposure to the elements, pyrotechnics are:

(1) To be wiped with a clean dry cloth, repacked into a suitable container, locally red-carded, and segregated for subsequent inspection; or

(2) If it is obvious the stores are non-repairable, they are to be destroyed at the earliest opportunity - such action does not apply to pyrotechnics installed for emergency use in aircraft or vessels which have been allocated a limited ‘operational’ life or otherwise subject to special servicing instructions.

2.11 If for any reason the airtightness of the package or inner liner is destroyed and all the contents of the open package are not expended at once, the airtightness is to be restored as far as possible, using plastic adhesive tape, if the application of the original method is impracticable (see Regulation 2.3 Procedure 3 Annex C).

Identification of Personnel who have conducted EO Packing or Repacking

Note

The following requirement is not necessary when utilising a Defence Transit Seal in accordance with Regulation 2.3 Procedure 3.

2.12 All packages containing EO must have a means of identifying who has packed or repacked the package, when it was packed/repacked and the location of where the packaging task was conducted.

2.13 There are two acceptable methods for meeting the requirement of paragraph 2.12, either stencilled externally to the package or by utilising Form GI 107.

a. **External Stencilling.** Where the person who has conducted the packing or repacking task is authorised to operate with a service issued work-mark and where that work-mark, date and location is easily identifiable from the outside of the package. This requirement is inclusive of those work-marks issued by the EO Services Provider to their staff. The identification details must not distract from the mandatory markings required for the package.

b. **Form GI 107.** Form GI 107 is to be affixed at first filling and subsequently whenever the EO is inspected and/or maintained in any way. Form GI 107 is to bear the name and full signature (or the work-mark stamp) of the person who conducted the packaging task. Form GI 107 is to be affixed to the EO package in the following locations:

(1) **Non-Guided EO Packages.** For Non-Guided EO the Form GI 107 is to be affixed to the inside of the lid of the package.

(2) **Guided Weapon EO Packages.** For Guided Weapon EO the Form GI 107 is to be affixed internal to the Guided Weapon package on the container base/side, or weapon securing devices, in such a way that the Form GI 107 is readily visible when the container is opened, unless otherwise specified in applicable Guided Weapon DEOP packing instruction.

Marking of Packages Containing Explosive Ordnance and their Components

2.14 Procedures pertaining to the markings to be applied to the exterior of packages containing EO, Non-Explosive Dangerous Goods (NEDG) and their associated non-explosive components are contained in Regulation 2.3 Procedure 4.

Annexes:

A. Authorisation of New and Alternative Packages and Packaging Methods for Explosive Ordnance

B. Packing and Repacking Label for Explosive Ordnance Packages (Form GI 107)

ANNEX A

AUTHORISATION OF NEW AND ALTERNATIVE PACKAGES AND PACKAGING METHODS FOR EXPLOSIVE ORDNANCE

1. This Annex prescribes the procedure for obtaining approval from the Explosive Materiel Branch (EMB) Packaging Team for the use of new or alternative packages and the associated packaging methods, by way of an Explosive Ordnance Packaging Method (EOPM) submission.

2. EOPM submissions are to be forwarded to the MUNB Packaging Team via the relevant MUNB Item Manager, for development and subsequent approval.

3. EOPM submissions are to be raised to address situations where:

a. the Method of Packing instructions are not particularly complex and a detailed Method of Packing Drawing is not required,

b. commercially supplied EO is to be repackaged into service packages,

c. the use of the approved service package is not compatible with the particular user stowage facilities available,

d. ratification of a commercial package as a service package is required, or

e. the approved Service package is not available.

4. EOPM submissions may be raised by EO Services Provider workshop staff under the authority of their Officer-in-Charge. Single Service EO storage, maintenance and distribution staff may also raise EOPM submissions, as required. Submissions are to state the reasons the applications are being made.

5. EOPM submissions are to give details of outer, inner and intermediate containers and the internal packaging arrangements are to be described by way of sketches and/or original photographs, to enable full development of the EOPM by the EMB Packaging Team. When submissions are raised to address the situations at sub-paragraphs 3b or 3d, the submissions are to include a copy of the manufacturer’s authoritative packaging method and/or packaging drawing, if available, otherwise the manufacturer’s packaging arrangements are to be adequately described.

6. On receipt of a submission, the EMB Packaging Team will develop the EOPM, assess it against UN Packaging Method requirements, assign a UN Number, UN Shipping Name, Hazard Classification Code and, if required, arrange for a Method of Packing Drawing to be prepared.

7. Where initial assessment raises concern as to the safety or suitability of the proposed packaging method, the EMB is to arrange for a detailed evaluation to be conducted.

8. Interim approval to use the packaging method may be forwarded to the originator by message or facsimile advising:

a. UN Number,

b. UN Shipping Name,

c. Hazard Classification Code,

d. Net Explosives Quantity, and

e. If codification action resulting from the new packaging method, is required.

9. Interim approval of the EOPM gives general authorisation to store and transport the EO in question using the packaging method described in the EOPM, pending formal amendment of Topic - 025 of the item publication.

10. An approved EOPM will be allocated a sequential EOPM number and distributed by the EMB.

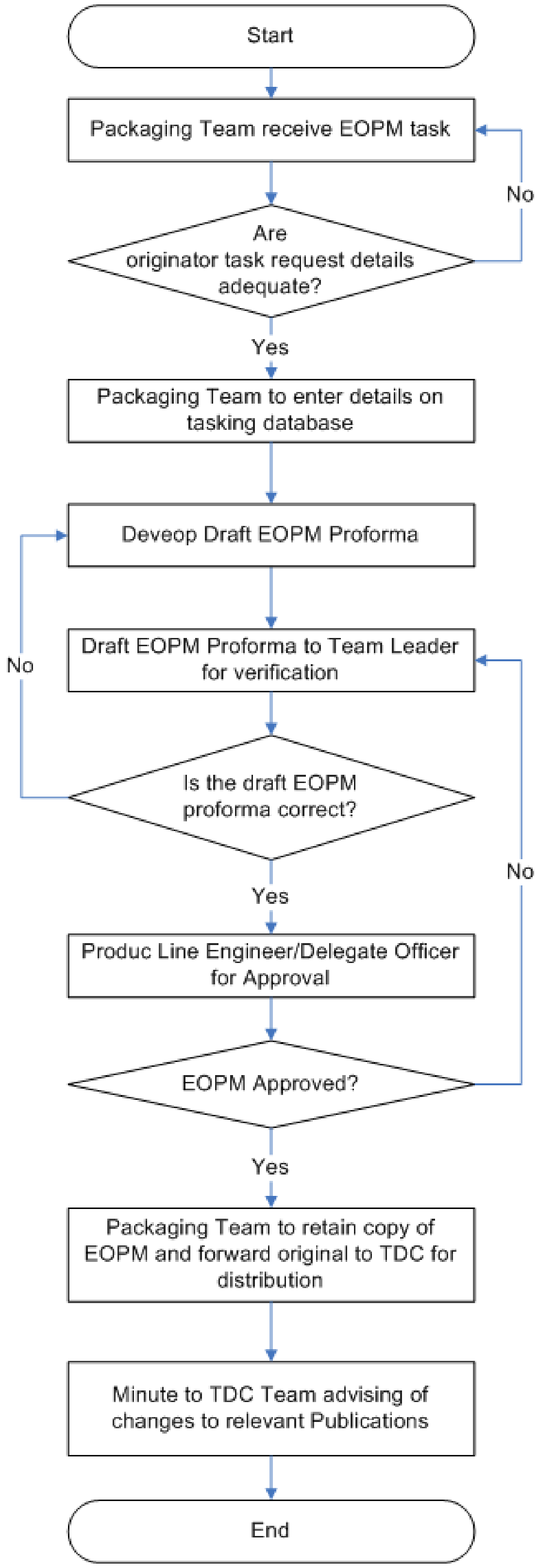
11. Topic - 025 will be amended by the EMB to reflect the approved EOPM on advice from the relevant Sustainment Manager.

Appendix:

1. Application for Explosive Ordnance Packaging Method - Flowchart

**APPENDIX 1 TO
ANNEX A**

APPLICATION FOR EXPLOSIVE ORDNANCE PACKAGING METHOD - FLOWCHART



Abbreviations:

EOPM	Explosive Ordnance Packaging Method
TDC	Technical Data Cell

ANNEX B

PACKING AND REPACKING LABEL FOR EXPLOSIVE ORDNANCE PACKAGES (FORM GI 107)

GI 107
Formerly N 215
Issued Mar 93

Department of Defence

PACKING AND REPACKING OF EXPLOSIVE ORDNANCE

Packed At:

....
(Establishment Monogram) *(Date)*

Packed By:

....
(Signature) *(Printed Name)*

Stock No

PROCEDURE 3 - CLOSING AND SEALING OF PACKAGES

Purpose

3.1 This procedure describes the type of sealing applicable to Explosive Ordnance (EO), i.e. authenticity and hermetic, and prescribes the actions to be taken when packages have been damaged or opened, or the sealing devices damaged.

Sealing Classifications

3.2 There are two methods of sealing packages of EO, Non-Explosive Dangerous Goods (NEDG) and their associated components. They are authenticity and hermetic sealing and are defined as follows:

a. **Authenticity Sealing.** Authenticity sealing is the application of seals to a package. Authenticity seals serve two purposes:

(1) to detect tampering; and

(2) to externally signify that the contents are correctly described by the data shown on the outside of the package/unit load, are correctly packed and the contents are serviceable unless there is a Condition Status Label on the package to indicate otherwise.

b. **Hermetic Sealing.** Hermetic sealing is the actual sealing of a component within a package, by an approved method, to prevent the ingress of water and moisture laden air. Certain EO has its explosive filling sealed by means of suitable luting, cements and varnishes, e.g. 5"/54 HE Projectiles; Mk 82 HE Bombs - such EO is classified as 'self-sealed'.

AUTHENTICITY SEALING – GENERAL REQUIREMENTS

3.3 All packages containing EO, NEDG and their associated components are to be authenticity sealed before being offered for transit or storage (see also Regulation 4.4 Procedure 2). Packages held in ready-use storage need not necessarily be sealed, although they are to be correctly closed. This principle also applies to empty packages (see Regulation 2.3 Procedure 5).

3.4 Authenticity sealed packages holding EO and NEDG are to bear a sufficient number of authenticity seals to ensure that the package cannot be opened without the seals being broken. Often this will require only one authenticity seal (this includes filling factory seals). In some cases, however, more than one seal will be required to be effective. EO packages are correctly authenticity sealed, provided the seals or a combination of seals and other markings show the establishment/filler's station monogram.

Types of Authenticity Seals

3.5 There are two types of authenticity sealing authorised for use. The first consists of linen or wafer seals and either metal, plastic or twister seals that are embossed with a station or manufacturer's monogram illustrated in Annex A and further described at paragraph 3.7 (this type is known as a Defence Logistic Seal (DLS)). This type of sealing when combined with a work-mark provides a guarantee that the EO has been inspected, packed and sealed by an authorised inspector and that the EO is either serviceable for use or is otherwise marked to indicate condition.

3.6 The second type is a Defence Transit Seal (DTS) illustrated and described at Annex B, which is authorised for use in accordance with the requirements of paragraph 3.10 and Annex B. Seals in use prior to 1 Jun 93, e.g. depot linen seals, Inspector of Naval Ordnance (INO) inspectorate seal and lead seals (also represented in Annex A) will still be seen on packages. Provided these seals bear a recognised station or manufacturer's monogram the seals are valid. Current seals are to be applied in accordance with paragraph 3.4 and paragraphs 3.10 to 3.16 inclusive.

3.7 The DLS represented in Annex A are typically applied by authorised EO Inspectors who operate within EO Logistic units (EO SD&M Contractor, DEOS, Joint Proof and Evaluation Unit (JPEU) etc.), including authorised Air Force personnel as described in paragraphs 3.26 -3.29 and DSTO personnel as described in paragraphs 3.33 – 3.36. They are applied as follows:

a. **Wafer or Linen Seals.** Wafer or linen seals may be used provided they are stamped with the station monogram and appear in conjunction with work-mark details applied in accordance with Regulation 1.5 Procedure 2. See figure 3-2 for a sample of a wafer or linen seal.

b. **Crushable Plastic Seals (and Wire[1]).** Crushable plastic and wire seals are to be impressed with the station monogram.

c. **Plastic Baglock Seals.** Plastic baglock seals are to be used in conjunction with a wafer or linen seal for traceability purposes or alternatively, work-mark details are to be applied to the package in accordance with Regulation 1.5 Procedure 2.

d. **Twister Seals.** Twister seals may be used provided they are stamped with the station monogram and are used in conjunction with wire to seal the package.

3.8 By agreement between organisations conducting the inspection of EO, the following plastic seal colours have been selected to represent each organisation:

a. **Blue.** The EO Storage, Distribution and Maintenance Contractor (currently Thales).

b. **Red.** Explosive Ordnance Inspectors working in Joint Logistics Command (JLC) and Inspectors working in Guided Weapons Maintenance Agencies (GWMA).

c. **Orange.** Explosive Ordnance Inspectors working in Joint Proof and Experimental Unit (JPEU).

d. **Green.** Logistics personnel, including authorised Air Force personnel as described in paragraphs 3.26 -3.29, and DSTO personnel as described in paragraphs 3.33 – 3.36, utilising authorised Station Monograms detailed in ESTC Pamphlet 5 - Monograms.

e. **Black.** Inspectors and Logistics personnel deployed overseas for operations utilising the authorised 'DEP' Station Monogram (refer Note below)

Note

Authorised 'DEP' EO sealing kits are available on request from Manager Technical Control Office, DEOS, Defence Establishment Orchard Hills, NSW 2748.

3.9 Currently, the plastic seals and crimping pliers used to emboss the station monogram are sourced from a commercial supplier, off the shelf. The preferred supplier is able to provide quantities of seals and crimpers through local state based agents. It should also be noted that the dies used in the crimpers usually take a few weeks to be manufactured to the preferred design. MOSD is able to provide the contact details and typical costing for these items.

3.10 Defence Transit Seals. Defence Transit Seals (DTS) are used by personnel who are not authorised EO Inspectors, to seal containers, packages (external or internal) and unit loads of EO that have been opened for use or user inspection and that are required to be offered for transport on public roads or are being transferred to another unit. Annex B details the design, application and use of DTS.

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[1] The wire used in conjunction with the crushable plastic authenticity seals has been identified as NSN 5340-66-161-9611, Part Number BAM12160D.

3.11 When Transit Seals are used for intra-establishment movements of stock the individual sealing the container is to annotate the Transit Seal with the unit's designation, and print and sign his/her name or apply an authorised work-mark instead of the name and signature.

3.12 A Packing/Repacking Label (Form GI 107) (see Regulation 2.3 Procedure 2) is not required to be enclosed in packages that are sealed with DTS.

Authenticity Seals – Methods of Sealing

3.13 Unless permitted in accordance with Regulation 4.4 Procedure 2, the resealing of packages is to be conducted in a licensed EO processing area.

3.14 At user establishments only, packages for the 'self-sealed' type of EO which have been opened for issue need not be resealed, except as required by paragraph 3.3. Such packages are to be marked 'opened' and/or 'fraction' as applicable in a suitable manner.

3.15 Before applying a DTS, the person sealing the package is to ensure that the:

a. Contents of each package are undamaged and correctly packed.

b. Package is correctly marked and is properly closed and secured (including the application of hermetic sealing devices if required.

c. Package is properly authenticity sealed with seals shown in Annex A.

3.16 When the condition of the contents is doubted, the matter is to be referred to an authorised Inspector of Explosives for advice and possible inspection.

3.17 Seals Broken during Handling or Transit. When a seal has been broken or damaged during handling or transit and interference with the contents or other damage has not occurred, the damaged seal is to be removed and replaced with an DTS marked with the words 'sealed in transit' by the supervisor in charge of loading or unloading, as appropriate. The relevant shipping documentation is to be annotated accordingly. If the package or its content is considered unsafe for further transport, the package is to be segregated or arrangements for its removal to a place of safety are to be made and an inspection by JLC EO Services staff or the EO Services Provider, as appropriate, is to be arranged.

3.18 Packages 'sealed in transit' are, on arrival at their destination, to be considered as being 'opened' and, if the receiving establishment or unit is an EO depot, they are to be submitted for broken seal or return inspection. If such a package is received at a user establishment/unit, the contents are to be examined by an authorised EO Inspector to determine their fitness for storage and use; the stockholder is responsible for ensuring that this examination is conducted before the items are placed in storage or issued for use. At the completion of the inspection, the package is to be resealed by the method prescribed in paragraphs 3.3 to 3.16 inclusive. Where there is doubt that the contents are serviceable, the package is to be segregated and arrangements made for an inspection by JLC EO Services staff or the EO Services Provider, as appropriate.

3.19 Broken authenticity seals are not conclusive evidence that the contents of a package have been exposed or interfered with and an appropriately qualified person is to determine this and act accordingly. When the contents of a package appear to have been interfered with, the package is to be immediately isolated with the minimum of handling and immediate action taken in accordance with Defence Security Manual, 2:67 - Explosive Ordnance Security.

Authenticity Sealing – Additional Requirements for Guided Weapon Packages

3.20 All packages containing guided weapons or guided weapon components are to be authenticity sealed for security before being offered for transit or storage. The protective security measures for guided weapons mandate that these packages may only be sealed or opened:

a. in a GWMA maintenance facility by authorised employees of the Commonwealth

b. at ADF user units or HMA Ships by authorised employees of the Commonwealth

or

c. by an Original Equipment Manufacturer (OEM) or EO Services Provider authorised by the relevant Guided Weapons Branch (GWB) Item Manager.

3.21 For latched packages containing guided missiles or guided missiles components, metal or plastic monogrammed seals used in conjunction with security lock-wire are the only authenticity sealing devices authorised for use. The plastic seal is represented in Annex A. The latched package is to bear a sufficient number of authenticity seals to ensure that it cannot be opened without the seals being broken.

3.22 For other guided weapons and other forms of packaging, monogrammed wafer seals may be used. The wafer seal is represented in Annex A. The package is to bear a sufficient number of authenticity seals to ensure that it cannot be opened without the seals being broken.

3.23 If any authenticity seals are found broken or damaged, inspection personnel are to quarantine the package in an appropriately secured area with controlled access and ensure the relevant GWB Item Manager is immediately notified. The GWB Item Manager will immediately arrange for authorised personnel to inspect the package and guided weapon or component.

3.24 Controlled Cryptographic Item. Certain guided weapons contain a Controlled Cryptographic (CCI) mandating that COMSEC personnel apply serial numbered and traceable tamper proof seals to the guided weapon packages, in addition to the above requirements. COMSEC personnel are to be notified prior to movements of, or opening of, CCI guided weapon packages. If any COMSEC tamper proof seals are found broken or damaged, inspection personnel are to isolate the package in an appropriately secured area, immediately notify COMSEC personnel and deny access to the package until COMSEC personnel arrive.

3.25 Enhanced End Use Monitoring (EEUM). An agreement exists between the Commonwealth of Australia and the United States of America to conduct routine inventory checks of certain guided weapons. As evidence that inventory checks of these guided weapons have been conducted by the Embassy of United States of America an authenticity seal is affixed to each guided weapon container. The authenticity seal affixed will be either plastic monogrammed seals used in conjunction with security lock-wire and monogrammed with the letters 'ODC' or alternately 'Golden Sentry' seals (sticker or metallic wire rope seal). The EEUM seals are represented in Annex A. No additional reporting requirements are necessary when containers are opened and the EEUM seals are removed; the guided weapons within the container will be subject to inventory check during the next schedule EEUM activity.

Additional Air Force Authorisations for Authentically Sealing EO Containers for Storage and Transport

3.26 Inspect, Repack and Reseal of EO. Air Force members who have completed one of the following courses may be authorised by their unit CO (see Regulation 1.5 Procedure 2) to inspect, repack and reseal with a DLS, in-service ADF EO where an authorised ADF procedure for the inspection and repack of that ordnance exists:

a. Armament Technician Course (PMKeys 212743)

b. Engineering Officer Armament Specialist Course (ENGOFFARMSPEC) (PMKeys 112694)

c. Supplier Explosive Ordnance Basic Course (PMKeys 113696); or

d. Broken Seal Examination Course (PMKeys 202784).

3.27 Air Force Inspector of Explosives. Air Force members who have completed one of the following courses may be authorised by their CO (see Regulation 1.5 Procedure 2) as an Air Force Inspector of Explosives:

a. Explosive Ordnance Supervisors Course (PMKeys 112962) and holds the minimum rank of Corporal (CPL)

b. ENGOFFSPEC (PMKeys 112694); or

c. Supply Specialist or Logistics officer who has completed Supplier Explosive Ordnance Advanced Course (PMKeys 212562).

3.28 This authorisation will allow a member to conduct all activities at paragraph 3.26 above as well as to supervise and certify by applying an individual work-mark, the inspection, repack, resealing and sentencing of ADF EO in accordance with the applicable ADF EO publication for that item of EO.

3.29 Defence Inspector of Explosives. Air Force ARMTECHs who have completed the Senior Explosive Ordnance Managers (SEOM) Course (PMKeys 112963) and achieve the minimum rank of Sergeant (SGT) and all Armament Officers (ARMOFFs), in addition to the above qualifications listed in paragraphs 3.26 – 3.28, may be authorised by the Senior Inspector Explosives (SIX), DEOS, JLC to inspect, repack, reseal, sentence and **certify safe for transport**, in accordance with Regulation 1.5, ADF EO in accordance with authorised EO publications.

3.30 The process for the authorisation and issue of individual Air Force work-marks is contained in Regulation 1.5 Procedure 2.

Air Force Instructions for Sealing EO Packages

3.31 In addition to the DLS applied by members in paragraph 3.26 above, a label GI 107 – Packing and Repacking of Explosive Ordnance, NSN 7530-66-126-2439 (see figure 3-1), is to be attached, in accordance with the process contained within Regulation 2.3 Procedure 2, and details of the member physically repacking the item are to be recorded on the label. The packing label (GI 107) provides an auditable trail of the member who physically conducted the repack.

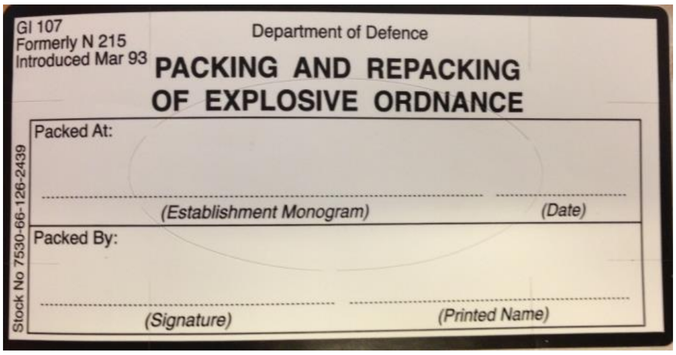


Figure 3-1 – Label GI 107

3.32 The member certifying the package is to use label EO 023, NSN 7690-66-149-1063 (see figure 3-2), attached to the outside of the container or pack and stamp their work-mark in the place provided.

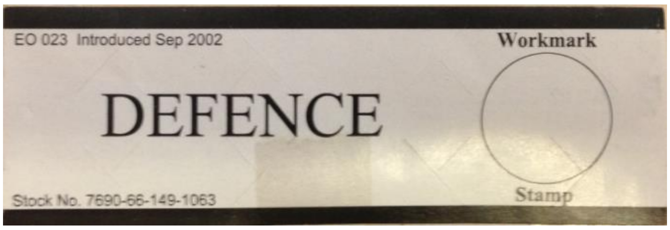


Figure 3-2 – Label EO 023

Additional DSTO Authorisations for Authentically Sealing EO Containers for Storage and Transport

3.33 Inspect, Repack and Reseal of EO. Defence Science and Technology Group (DSTG) members who have completed one of the following courses may be authorised by their Chief of Division (see Regulation 1.5 Procedure 2) to inspect, repack and reseal DSTG managed EO, Explosive Materiel (EM) and Energetic Substances (ES), with a Defence Logistics Seal (DLS):

a. Supplier Explosive Ordnance Basic Course (PMKeys 113696).

b. Broken Seal Examination Course (PMKeys 202784).

3.34 DSTG members who are authorised to conduct authentic sealing, via use of the DLS, are limited to:

a. In-service ADF EO where an authorised ADF procedure for the inspection and repack of that ordnance exists.

b. Items of R&D EO with an approved DSTG EO Life Management Plan and authorised DEOCL (Note, information may be derived from DEOP series of publications or the UN transportation guide).

3.35 DSTO Inspector of Explosives. DSTG members who have completed one of the following courses and have a minimum of 3 years in identified roles may be authorised by their Chief of Division (see Regulation 1.5 Procedure 2) as a DSTG Inspector of Explosives:

a. EO Management Specialist who has completed Supplier Explosive Ordnance Advanced Course (PMKeys 212562).

b. Explosive Ordnance Supervisors Course (PMKeys 112962).

c. Explosive Ordnance Managers Course (PMKeys 112961).

3.36 This authorisation will allow a member to conduct all activities at paragraphs 3.33 - 3.34 above as well as supervise and certify by applying an individual work-mark, the inspection, repack, resealing with the applicable ADF EO publication for that item of EO and Research and Development (R&D) EO with an approved DSTG EO Life Management Plan and authorised DEOCL.

HERMETIC SEALING

3.37 To maintain EO in a serviceable state they are either themselves sealed against any ingress of atmospheric moisture, i.e. self-sealed, or are packed in suitable hermetically sealed packages to give this protection. The type of sealing varies, but whatever form of sealing is employed it is important that it is maintained until the last possible moment before the EO is used.

3.38 The term ‘barrier bag’ is often used to describe the inner package that protects the contents from the atmospheric or radiation hazard environment likely to be encountered in storage. It is not necessarily completely impervious to air or moisture, provided that it affords the contents adequate protection for the likely period of storage and meets the requirements of the relevant packaging drawing or other instruction.

3.39 The life of certain EO, e.g. impulse cartridges, is limited once the hermetic seal is destroyed, ie when the user has opened the cylinder and the EO has become ‘exposed’. Other EO similarly exposed, but less vulnerable, still has a useful life subject to satisfactory inspection and proof, and resealing under correct hygrometric conditions, but it is essential that the correct state of the EO and packages is known.

3.40 EO that is packaged for protection from the atmosphere, i.e. hermetically sealed, is exposed when the packages have either been opened for use or have become damaged so as to render the sealing ineffective. EO that is normally unpackaged or is in non-airtight packages, i.e. is self-sealed, is only to be considered exposed when its visual condition indicates its sealing devices, i.e. luting, adhesives or varnishes, are damaged.

3.41 When the original method of hermetically sealing containers is impracticable the airtightness is to be restored using PVC adhesive tape and the method described in Annex C.

3.42 EO that has been exposed but, after due inspection and proof, has been sentenced serviceable and repacked is to be marked 'First Issue' and issued for use at the earliest opportunity. Packages so marked may be stacked with the portion of the same lot, but are not to be mixed within the stack.

3.43 When submitted for inspection, all portions of a lot of EO are to be included on the same inspection form separately shown as 'sealed', 'exposed', 'closed' or 'resealed' (see paragraph 3.40), as appropriate. Self-sealed stores considered to be 'exposed' are to be dealt with according to the result of the inspection.

3.44 **Hermetic Sealing Classifications.** The terminology, abbreviations and definitions which are to apply within the classification of hermetic sealing are as follows:

a. **Sealed (S).** EO and packages are considered 'sealed' when:

(1) EO, by the nature of its construction is air and watertight, e.g. bombs and shells. This includes EO which is considered 'self-sealed', held in non-airtight packages bearing authenticity seals; or

(2) packages are hermetically sealed and bear authenticity seals.

b. **Closed (C).** A package is considered 'closed' when all the internal packing has been correctly replaced, the lid is replaced, including auxiliary lids, and securing devices and hermetic seals have been applied where applicable, and does not bear authenticity seals.

c. **Resealed (RS).** EO which has been issued for use, or, packages which have been opened to make issues and have been reclosed by approved means other than the original method of sealing, are to be considered as 'resealed'.

d. **Exposed (E).** EO is considered 'exposed' when it has been opened to the air. This includes EO:

(1) Which has faulty or missing hermetic sealing devices.

(2) Other than 'self-sealed' held in open packages.

(3) Other than 'self-sealed' held in racks or packs.

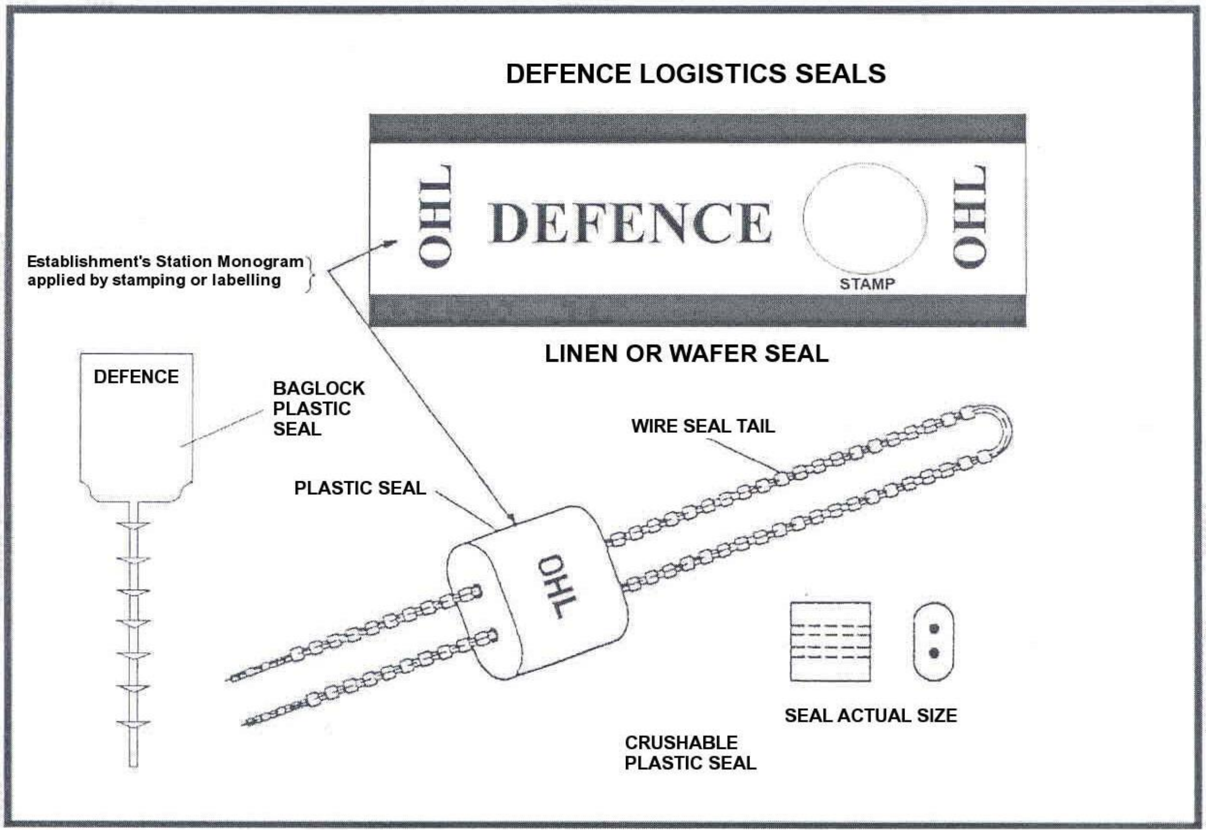
(4) Which has a 'restricted' life after opening of hermetic sealing.

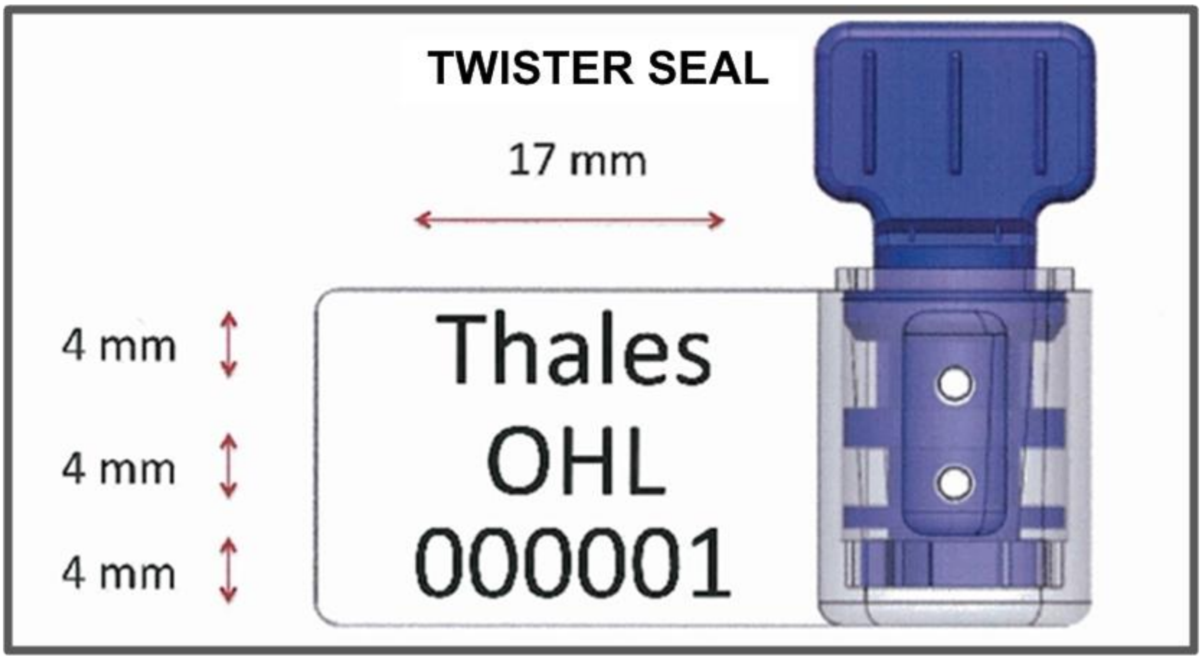
Annexes:

A. Current and Superseded DLS for Explosive Ordnance Packages
B. Application and Use of Defence Transit Seals
C. Resealing of Packages

ANNEX A

CURRENT AND SUPERSEDED DEFENCE LOGISTIC SEALS (DLS) FOR EXPLOSIVE ORDNANCE PACKAGES

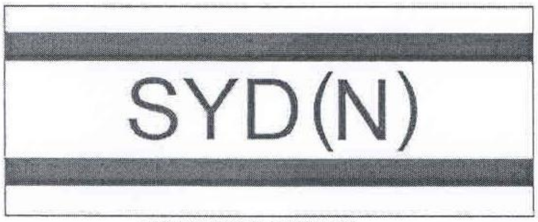




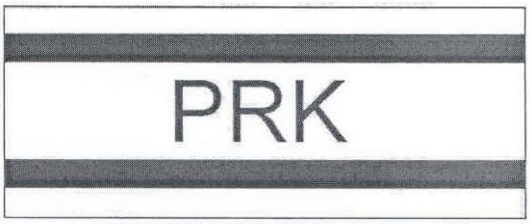
ANNEX A

ENHANCED END USE MONITORING SEALS

SUPERSEDED DEPOT AND CONDITION DEFENCE LOGISTIC SEALS



SUPERSEDED RAN SEAL



SUPERSEDED RAAF SEAL

SUPERSEDED RAAF ENGRAVED METALLIC SEAL

SUPERSEDED LEAD SEAL

ANNEX B

APPLICATION AND USE OF DEFENCE TRANSIT SEALS

Introduction

1. Any filled Explosive Ordnance (EO) packages offered for transportation in the public domain are to be correctly sealed with authorised authenticity seals. A special authenticity seal, referred to as the Defence Transit Seal (DTS), exists for use by personnel who are not EO Inspectors, to seal packages for transportation purposes.

2. The application and use of DTS is limited to closed packages and unit loads with broken original seals so that such EO may be transported via the public domain. Also, the distinctive features of the DTS allow for easy recognition of EO as not having been packed by an EO Inspector and therefore requiring inspection and re–packing by an EO Inspector at the earliest opportunity.

Purpose

3. This instruction defines the application and use of DTS.

Application

4. DTS are applied to EO packages or unit loads to:

a. detect tampering during handling and transportation;

b. signify that the contents are correctly packed, accurately described by the data shown on the outside of the package or unit load; and

c. signify the EO is safe for handling and transportation.

5. For EO logistic storage depot operations, all packages of EO sealed with DTS are to be afforded priority in processing the EO through an appropriate inspection to ascertain the quantity and serviceability of the EO. The EO is to be segregated pending inspection and sentencing and subsequent sealing with DLS. Although not formally required, closed packages of EO held in unit storage without DLS may be sealed with DTS.

6. An illustration of the DTS is at Appendix 1.

Typical Use of Defence Transit Seals

7. The following scenarios indicate how DTS may be used noting however, that in all instances these seals are to be applied only by authorised personnel who have been appropriately trained and assessed to be competent for the task (see Regulation 1.1):

a. **Serviceable EO at De-ammunitioning.** A ship's Explosives Custodian Officer, or his/her delegated representative holding the rank of Senior Sailor as a minimum, may seal all broken seal packages or unit loads of serviceable EO with sufficient DTS to ensure that opening the package or unit load will break at least one seal. Additionally, such packages are to be labelled as required by ABR 862 Volume 2, Chapter 5. Defective, damaged, malfunctioned or misfired EO is to be dealt with as provided for at sub-paragraph c or d, as appropriate.

b. **Serviceable EO for Range Practices and Exercises.** EO for Range Practices, Exercises or other similar activities may be transported to or from such activities provided the EO packages have intact authenticity seals. If the seals are broken and the EO is Serviceable, packed in its authorised package in accordance with authorised packaging arrangements, and the pack is correctly marked (see paragraph 4), the seals may be replaced with DTS, in lieu of the usual DLS.

Annex B

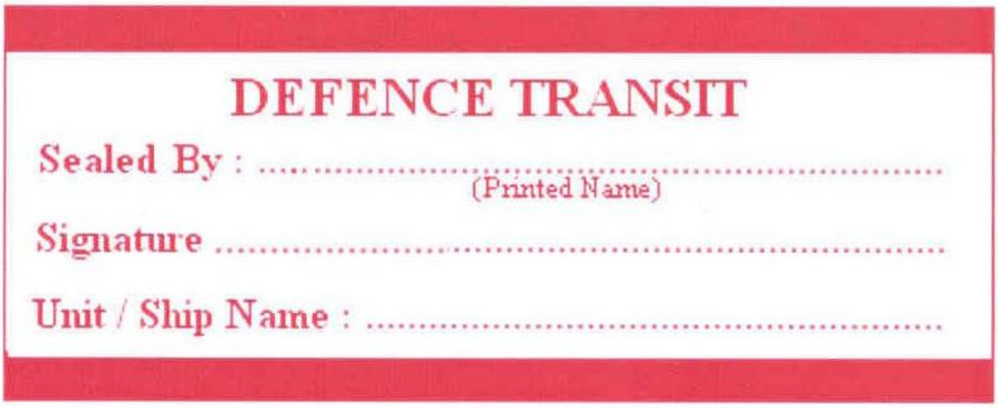
c. **Defective, Damaged, Malfunctioned or Misfired EO (Except SAA).** Damaged and especially malfunctioned or misfired EO should not normally be handled in any way except when all other methods for disposal have been considered and rejected. When a decision is taken that packages or unit loads of defective, damaged, malfunctioned or misfired EO are required to be returned to a Defence establishment, the EO is examined by an EO Inspector to ensure it is safe to transport and subsequently packed 'workmarked' and sealed with DLS. The requirements of Regulation 2.3 Procedure 6, paragraphs 6.18 to 6.21 also apply. SAA may be dealt with as provided for at sub-paragraph d below.

d. **Defective, Damaged, Malfunctioned or Misfired SAA.** If defective, damaged, malfunctioned or misfired SAA is required to be returned to a Defence establishment, the SAA is to be packed in its authorised package in accordance with authorised packaging arrangements and the pack is to be correctly marked (see paragraph 4). The package is to be sealed with DTS and a Form EO 047/048 Warning – Damaged Store Label attached to the package. The requirements of Regulation 2.3 Procedure 6, paragraphs 6.18 to 6.21 also apply.

Appendix:
1. Illustration of Defence Transit Seal

**APPENDIX 1 TO
ANNEX B**

ILLUSTRATION OF DEFENCE TRANSIT SEAL



ANNEX C

RESEALING OF PACKAGES

Introduction

1. Often it is necessary during inspection and proof of explosive ordnance to open hermetically sealed packages to inspect the contents or select proof samples. Unpacking/packing of stores that require protection from atmospheric conditions should be conducted in workshops that are environmentally controlled, see Regulation 4.1 Procedure 5.

2. If, for any reason, the airtightness of a package or inner liner is destroyed and the contents of the opened packages are not expended at once, the airtightness is to be restored before the package is returned to storage. If the original method of sealing is impractical, airtightness may be restored by using plastic (PVC) adhesive tape in accordance with paragraphs 3 and 4. If the inner packaging was a polyethylene barrier bag, it is to be resealed, if necessary using a new bag, in accordance with paragraphs 5 and 6.

Material Required

3. Any PVC electrical insulating tape is suitable for resealing.

Method

4. Reseal the packages as follows:

a. Select the tape, ensuring that the width is suitable with respect to the size of the container and the distance between the surfaces to be sealed.

b. Ensure that the surfaces are clean and smooth to obtain a good seal.

c. The tape is to extend at least 12 mm on each side of the gap between the lid and the container. Creasing or bulging, which will permit leakage, is to be avoided.

d. The length of the mated surfaces is to be covered to ensure a complete seal.

e. In the case of plastic, foil or treated fabric, and bag type containers or liners, a strip of tape wide enough to enclose both surfaces and provide an airtight seal is to be applied.

f. After completing the seal, cut the tape and turn back a section of the tape to form a tear-off tab. An effective tab is about 25 mm long.

Barrier Bags

5. Prior to opening items sealed in barrier bags that will require resealing, a sealing machine with a quantity of barrier materials is to be available. If the packaging drawing or instruction requires complete evacuation of air from the bag, a vacuum device is also to be available.

6. Air is to be removed from the bag by hand or the vacuum device, depending on the packaging drawing or instruction, and the bags are to be resealed after the inspections have been completed or samples extracted. Barrier bags are not to be left open overnight. When required, additional bags are to be fabricated. Sufficient borders are to be included in the new bags to allow for subsequent inspections and resealing.

PROCEDURE 4 –MARKING AND LABELLING OF EXPLOSIVE ORDNANCE PACKAGES

Introduction

4.1. This procedure prescribes the requirements for marking and labelling of Explosive Ordnance (EO) packages to facilitate item identification along with requirements for storage and road/rail transport purposes. For the transport of EO by civilian air/sea refer to the relevant Competent Authority document, International Air Transport Association (IATA) Dangerous Goods Regulations (DGR) and International Maritime Dangerous Goods (IMDG) Code respectively. The marking of EO is addressed in Regulation 2.3 Procedure 1.

4.2. Direction on additional markings for containers e.g. 'Fragile – Handle with Care', lift and tie down points, cover lift only points, etc, not contained within this procedure can be obtained from the EO Management Agency.

Purpose of Marking and Labelling

4.3. The marking and labelling of EO packages is essential to ensure quick, correct, and sufficient identification of the contents at all times. More specifically, markings and labels are applied for the following reasons:

a. To facilitate the issue of the correct nature and type of EO, to enable EO to be clearly and easily identified by the user under all conditions of service and to provide the user with the maximum information possible concerning the nature, type and function of the EO supplied;

b. To provide all necessary details to assist inspection, to guard against the supply of faulty or unproved/unauthorised EO to users, to aid investigation into causes of faulty operation or defects and to trace suspect EO, as well as to provide information for EO surveillance activities; and

c. To provide sufficient information to storage, transport, accounting and other services to ensure that all EO is correctly stored, handled and transported according to the nature of the EO or other risk for which it is classified in accordance with current regulations.

Applicability

4.4. The basic colours, marking colours and details of package and contents identification markings described in this procedure relate in general to packages for:

a. Items of EO.

b. Non-explosive items managed as items of EO.

Definition of Marking Surfaces

4.5. **Rectangular Packages.** With the package on its design base, select one of the larger vertical surfaces for the contents identification markings. This surface will thereafter be referred to as the front of the package, and from this can be deduced the lid or top, the ends, and the rear. For packages having hinged lids the rear will normally be the vertical surface to which the hinges are attached.

4.6. **Cylindrical Packages.** Contents identification markings are to be applied to one vertical half of the cylinder.

Methods of Identification – General

4.7. The following methods of identification are to be used in the marking of packages:

a. Permanent markings;

b. Basic overall colours;

c. Non-permanent markings;

d. Symbols and other special details, where required; and

e. Labels.

Non-Permanent Marking of Filled, Overpacks, Outer, Intermediate and Inner Packages

4.8. **General.** Markings (including stencilled details, symbols, labels, etc) are intended to provide sufficient information to identify the contents and, where applicable, the nature of their filling, their Hazard Classification Code and other details. Where the available surface is inadequate for full descriptive markings, approved abbreviations are to be used or are otherwise to be sought from the EO Management Agency. Markings are normally applied by stencilling, however, some or all of the markings may be applied by transfer printing or self-adhesive labels. For packages made from plastics, stencilling or similar methods of marking may be found to be impracticable. In such instances identification details may be printed on labels or the details may be printed directly on to adhesive tape affixed to the package.

4.9. **Overpacks.** Overpacks are becoming common as logistical covers which allow multiple outer packs to be transported together. They allow for easier handling and improve stacking properties whilst also providing protection of the outer pack against banding. Marking of overpacks shall comply with the requirements given in the Australian Explosives Code (AE Code) and the Australian Dangerous Goods Code (ADGC).

Mandatory Markings.

4.10. **Outer Packages.** Filled EO outer packages (this includes intermediate and inner packages that are authorised to be used as outer packages) are to be sealed in accordance with Regulation 2.3 Procedure 3 and marked in accordance with the AE Code, Chapter 3. Compliance with the AE Code is a statutory requirement.

4.11. **Additional Statutory Markings for Certain Packages.** Plastic explosives contained, enclosed or packaged in a wrapper are to have the following markings on the wrapper in accordance with the Marplex Convention:

a. The expression ‘PLASTIC EXPLOSIVE’ in upper case lettering;

b. The date of manufacture of the plastic explosive;

c. If the plastic explosive is a prescribed type – that type;

d. If the plastic explosive contains a detection agent, the name of the detection agent; and

e. If the plastic explosive contains a detection agent, the concentration of the detection agent in the plastic explosive at the time of manufacture. This is to be expressed as a percentage by mass.

4.12. **Mandatory Technical Markings (if applicable).** Any special marking identified in the design acceptance process e.g. Unpacked Life, SOLAS stores and temperature limitations for both storage and use. These markings will be advised by the EO Management Agency.

4.13. **Mandatory Logistic Markings.** Mandatory logistics markings are not statutory markings as required by the AE Code but are considered necessary for logistical management of the EO. These markings are not to obscure the statutory markings and are to be small in size, they include:

a. Stock Number (NSN).

b. Gross mass of the package to one decimal place (WT).

c. External volume of the package preferably to three decimal places (CU).

4.14. **Exceptions to the mandatory Logistic Markings requirement.** Inventory subject to the following approved conditions may be authorised for issue without the mandatory logistic marking as indicated in paragraph 4.13 as long as the statutory mandatory markings are present in accordance with paragraph 4.10:

a. Receipted inventory required for immediate operational issue to meet capability.

b. EO that has been identified for Disposal.

c. EO obtained for trial purposes prior to or in support of the Introduction in to Service process.

4.15. Any stock identified under the conditions specified in paragraph 4.14 is to have the necessary means of identification to permit management through logistics systems. It must be acknowledged that these identification features are not physically marked on the package. Such stock must be held segregated, including the accounting record, and placarded for identification from similar stock.

Notes:

Markings are normally provided in metric units eg millimetres however stock purchased through Foreign Military Services (FMS) may be marked in imperial units eg inches. Stock marked as such is acceptable to be issued however it is to be converted to metric units when any maintenance/refurbishment in an EO workshop is conducted.

The AE Code accepts the mandatory markings from other Dangerous Goods Codes eg IMDG, UN Model Regulations etc.

4.16. **Additional Logistics Markings.** The following additional logistics markings are logistic markings that are to be applied when the circumstances arise:

a. **Operational Abbreviations and Symbols.** For new EO introduced into Service, the EO Management Agency is responsible for determining, in liaison with the appropriate Service Capability Manager, whether or not item operational abbreviations and symbols will apply.

b. **First Issue.** FIRST USE' label (EO102): if applicable. This label identifies EO containers that have been previously opened and are therefore to be issued in the first instance.

c. **Fraction.** Packages containing less than the full quantity of stores in the original equipment manufacturer (OEM) approved package are to have a 'FRACTION' label or the word stencilled in white on the package.

Requirements for Applying Markings

4.17. **Source of Marking and Labelling Information.** UN Proper Shipping Name, Service Nomenclature, Operational Abbreviations (if applicable), Stock Number, Quantity per package, UN Number, HCC and Subsidiary Risk (if applicable), NEQ, gross weight and volume details are detailed in approved information provided by the EO Management Agency and in the Explosives Storage and Transport Committee Pamphlet No. 2 – Defence Explosive Ordnance Classification Listing (DEOCL).

4.18. **Methods of Marking.** Stencilling remains the main method of displaying essential non-permanent marking detail, however because stencilling on certain surfaces may be impracticable, pre-printed self-adhesive labels may also be used provided the labels are appropriately durable for their intended purpose.

4.19. **Size of Markings.** Only Latin letters and Arabic figures are to be used for main contents identification markings. They are to be large enough to be clearly legible within the limits imposed by the size and shape of the packages and the space available for markings. Three comparative sizes may be used, where practicable, in the proportions 2:1.5:1 respectively, as follows:

a. **Large.** Limited use only, for certain symbols and any special markings requiring prominence, such as shortened version of usual nomenclature, eg Cartridge 81 mm Smoke WP Fuzed PD524A6 - 81 MOR SMK WP FZD.

b. **Medium.** For item nomenclature, filling and propellant abbreviation codes and certain symbols.

c. **Small.** For all other general markings such as lot details, etc.

4.20. **Use of Abbreviations.** Only abbreviations approved by EO Management Agency are to be used for the item nomenclature where space is restricted, except for the colour effect of smoke, flare or pyrotechnic ammunition when the colour must be spelled out in full. For units of measurement and weight, only the standard abbreviations are to be used, eg mm for millimetre, kg for kilogram, in for inch, lb for pound, g for gram, gr for grain, etc.

4.21. **Position of Markings and Method of Packing.** The controlling documents for marking of EO packages are approved drawings from the EO Management Agency which provide both packing and marking details. These approved drawings are part of the approved configuration package. The approved drawings are found in the EO publications library either in the General Packaging Data and Marking Templates section, as in the case for non-guided items or for guided weapon packages, in the relevant item publication.

4.22. **Colour of Packaging and Markings.** The following colours (to Specifications APAS 0020 or APAS 0024/1 or A-A-208 (MILSPEC)) are preferred to be used for marking packages:

a. White on olive drab lustreless.

b. Black on unpainted or natural finishes.

c. Black on grey.

d. White on signal red.

e. Inspection and other work-marking are to be in golden yellow.

f. Additional colour schemes may be authorised by the EO Management Agency following liaison with relevant Service Capability Managers.

g. All package finishes are to be free of hazardous materials such as Zinc Chromate, Polyurethane (PUP) or Lead based paint.

4.23. **Exceptions.** Packages made from the following materials need not be painted but may have an approved finish as required:

a. Galvanised steel;

b. Aluminium and its alloys;

c. Glass fibre;

d. Plastics and similar materials; and

e. Fibreboard.

4.24. **Inner and Intermediate Packages.** Inner and intermediate packages that may be used as an authorised alternate to the outer package should have a finish in accordance with paragraph 4.22. Inner and intermediate packages not intended to be used as outer packages are to have a finish acceptable to the EO Management Agency.

Marking of Unit Loads or Special Crates and Transit Containers

4.25. Where a number of outer packages, each marked in accordance with the requirements of this procedure are assembled into a unit load or a special crate or similar transit container, the unit load, crate or container is to be marked in accordance with Regulation 4.1 Procedure 10.

4.26. Some unboxed items are authorised to be transported in an unpackaged state. Items so authorised may be stored and transported, including issue to and return from a user unit, using a GI 49 (placard) and GI 50 (Unit Load Content Record) to display mandatory markings. Refer to Regulation 4.8 Procedure 1 for further details on the use of Forms GI 49 and GI 50. Items so authorised do not have outer packaging eg 155 mm Unguided Projectile or Mk 80 Series Bombs.

Labels

4.27. Labels are often used to convey contents identification and other information on external surfaces of packages as well as internally. All forms of labels are to be tested by an appropriate testing authority to demonstrate their durability in the expected Service environment. The following labels are in common use although stencilling can be used instead in some instances:

a. **Dangerous Goods Class 1 Label.** This marking, more commonly known as the Explosives Class Label is to be applied to all approved outer packages containing EO which is classified for transport and storage as a military explosive. Explosives Class Labels are to be applied also to intermediate and inner packages if these packages are liable for separate issue. Examples of Explosive Class Label are detailed in Annex A.

b. **Dangerous Goods Subsidiary Risk Label.** A few items of EO in the inventory are required to have attached to their packaging, Subsidiary Risk Labels which convey the secondary hazard associated with the content of that specific item. Because of the limited number of items requiring such markings, no special provision has been made on marking diagrams for their positioning on packages. When Subsidiary Risk Labels are to be applied to packages they are to be positioned next to the Explosives Class Label and the UN number.

4.28. **Packer's Labels.** When closing or reclosing any package containing EO, the details of the person who conducted the packing are to either stencil their assigned work-mark, location and date on the outside of the package in accordance with approved service procedures or by using form GI 107 - Packing and Repacking label. Further information regarding the packing or repacking of EO is found in Regulation 2.3 Procedure 2.

4.29. **Condition Status Labels.** Condition Status Labels are used to indicate the serviceability status of EO. Annex B defines the use of Condition Status Labels with EO.

4.30. **Contents Labels.** Serial number and lot details may be recorded on Contents Labels. The labels are to be so positioned as to be visible when the packages are stacked and this will usually mean affixing the label to one end of the package. Where possible, the label should be in a recess or in the lee of a handle for protection against damage.

4.31. **Special Identification, Instructional or Warning Labels.** Special identification, instructional or warning labels are sometimes required on packages and, where used, are to be affixed to the exterior of the package in any convenient position which does not obscure stencilling, stamping or other labels. Instructional labels are occasionally required to be positioned under the lid.

4.32. An item of EO that is suspected of being dropped or damaged, outside the acceptability criteria or design limit summary as stated in the item publication, is to have a 'Warning - Damaged Store' label (form EO 047/048) completed and attached to the item and the outside of its package, in a readily visible position when the item is packaged for transport or storage. A Certificate of Safety (form SG-131) will be required to be completed in these instances, refer to Regulation 3.1 Procedure 2. A specimen of the 'Warning – Damaged Store' label is given in Annex B.

4.33. **Inks for Paper Labels.** Information inserted on paper labels used for packages containing EO is to be provided by printing or by indelible stamp as far as practicable. Where it may be necessary to insert details in manuscript, permanent waterproof black drawing ink or blue black record ink is to be used. Details are normally to be inserted in block capitals and Arabic numerals.

4.34. **Supply of Labels.** Supplies of labels required for Defence EO use are held at ADF Supply Centres and are obtainable on demand.

4.35. **Metal Labels and Tags.** Metal labels or tags for identification, instructional or warning purposes are not normally used on packages owing to the danger of loss in transit.

Inspection and other Work-marking

4.36. The requirements for inspection and other work-marking are given in Regulation 1.5 Procedure 2 and relevant Maintenance Instructions. All such markings are to conform to those requirements.

Sealing of Filled Packages

4.37. All packages containing EO are to be sealed in such a manner that the package cannot be opened without breaking the seal. The seal must bear the initials or monogram of the establishment, unit or factory last sealing the package (see Regulation 2.3 Procedure 3 for details).

Annexes

A. Explosive Class Label for Explosive Ordnance

B. Condition Status Labels for Explosive Ordnance

ANNEX A

EXPLOSIVE CLASS LABEL FOR EXPLOSIVE ORDNANCE

Figure 4A-1 – Class 1 (Explosives) Labels for Explosives Substances and Articles.

1. Full details of the Class 1 (Explosives) Labels are available in the Australian Explosives Code.

ANNEX B

CONDITION STATUS LABELS FOR EXPLOSIVE ORDNANCE

Introduction

1. The imperative to communicate the results from inspections, sentencing and subsequent accounting activities undertaken on Defence stocks (indicating the condition status of Explosive Ordnance (EO) and associated components), has led to the creation of Condition Codes as a means to assist with the management of stock.

2. A system of labelling has therefore been developed and is used to indicate the serviceability status of EO. The labels are referred to as Condition Status Labels.

Purpose

3. This Annex defines the available Condition Codes plus the configuration and use of Condition Status Labels with EO.

Application

4. Condition Codes and their status labels are used to indicate the serviceability status of EO for each 'unit of issue'. However, not all 'units of issue' of EO will be required to have Condition Status Labels affixed. Examples are when the:

a. contents of correctly authenticity sealed packages/containers etc, can be assumed to be serviceable (see Regulation 2.3 Procedure 3) and will not require labelling.

b. condition status of all packages/containers/unpackaged items of EO, comprising a Unit Load can be signified by a single Condition Status Label attached to the Unit Load.

5. When the contents of packages/containers/Unit Loads etc, are other than serviceable, the condition is to be indicated by a Condition Status Label. If doubt exists as to the condition of the EO, the Manager Explosive Ordnance Safety and Reliability in the Explosive Materiel Branch (EMB) or the nearest Joint Logistics Unit Explosive Ordnance Services (JLU EOS), is to be contacted for advice.

6. Condition Codes are typically used in conjunction with Account Codes. Account Codes are applied to EO within logistics IT systems such as the Computer Support for Armaments (COMSARM) and are used by Inventory Managers to segregate stock into discrete groups to facilitate its management. Further information on Account Codes and their use is found in the Electronic Supply Chain Manual (ESCM) Volume 13, Section 9, Chapter 10.

Condition Codes

7. There are nine Condition Codes in service. Occasions for the use of each are as follows:

a. **Serviceable.** The SERVICEABLE (S) condition code is used to indicate that EO:

(1) meets the appropriate specifications for manufacture and testing

(2) is ready for fitment or use without performing any actions on the EO other than preparation for issue and use; or

(3) if in a used condition, is within acceptable limits of deviation from its original or modified condition.

b. **Serviceable Restricted.** The SERVICEABLE RESTRICTED (SR) condition code is as for a SERVICEABLE code except the EO is subject to some form of restriction in relation to its use, e.g. ammunition is not to be fired over the heads of troops.

c. **Serviceable Not in Service.** The SERVICEABLE NOT IN SERVICE (SX) condition code is as for a SERVICEABLE code except that the EO has not been accepted into Defence service, e.g. EO is undergoing design certification supporting introduction into service or awaiting trials.

d. **Serviceable Contingent.** The SERVICEABLE CONTINGENT (SC) condition code is as for a SERVICEABLE code except that the Capability Manager has specified the end user/s of the item. A time limit of up to 24 months applies and allows the Services to accept the item for operational use under a waiver. A Stock Management Instruction (SMI) has been issued however an EO Design Certificate (EODC) Trials or an EODC Contingency only is issued.

e. **Repairable.** The REPAIRABLE (R) condition code used to indicate that EO is capable of being repaired and that the repair is an acceptable alternative to disposal in prevailing circumstances.

f. **Repairable Restricted.** The REPAIRABLE RESTRICTED (RR) condition code is as for a REPAIRABLE code except the EO is subject to a restriction in relation to its use.

g. **Repairable Not in Service.** The REPAIRABLE NOT IN SERVICE (RX) condition code is as for a REPAIRABLE code except that the EO has not been accepted into Defence service, e.g. EO is undergoing design certification supporting introduction into service or awaiting trials but has failed known inspection criteria.

h. **Pending.** The PENDING (P) condition code is used to indicate EO which has been set aside and on which tests, investigations or further inspections are to be conducted before it can be sentenced, i.e. assigned, any one of the other Condition Codes, as appropriate, depending on the results of those tests, investigations or inspections.

i. **Not Repairable.** The NOT REPAIRABLE (NR) condition code is used to indicate that EO is:

(1) not capable of being made serviceable through an authorised maintenance activity

(2) uneconomical to repair; or

(3) confirmed as not to be repaired.

Condition Status Labels

8. The ten Condition Status labels are authorised by this procedure. The labels are based on the internationally accepted colours for equipment status labels as follows:

a. SERVICEABLE - Green label.

b. SERVICEABLE RESTRICTED – modified SERVICEABLE label – see paragraph 9 for details.

c. SERVICEABLE NOT IN SERVICE – modified SERVICEABLE label – see paragraph 9 for details.

d. SERVICEABLE CONTINGENT – modified SERVICEABLE LABEL – see paragraph 9.

e. REPAIRABLE - Yellow label.

ANNEX B

f. REPAIRABLE RESTRICTED - modified REPAIRABLE label – see paragraph 9 for details. The label may be over-stamped in bold type ‘PRIORITY’ to indicate that the EO is to be repaired at the earliest opportunity to prevent further deterioration of the EO.

g. REPAIRABLE NOT IN SERVICE – modified REPAIRABLE label – see paragraph 9 for details.

h. PENDING - Black label.

i. NOT REPAIRABLE – Red label.

j. WARNING – DAMAGED STORE – White label with red stripes.

9. Because the requirement for SERVICEABLE RESTRICTED, SERVICEABLE NOT IN SERVICE, SERVICEABLE CONTINGENT, REPAIRABLE RESTRICTED and REPAIRABLE NOT IN SERVICE labels is expected to be limited, separate labels will not be produced. Instead SERVICEABLE or REPAIRABLE labels, as appropriate, are to be modified by printing or stamping the word/phrase RESTRICTED/NOT IN SERVICE/CONTINGENT, as required, in bold red letters across the face of a SERVICEABLE or REPAIRABLE label to obtain the required label.

10. The Condition Status Labels are illustrated in Appendix 1. The labels are produced in configurations and sizes as follows:

a. **Large.** The large label is a composite tag and label that may be used as a tie-on tag or the coloured section removed and used as a self-adhesive label. The nominal dimensions of the label are as a:

(1) tag, 143 mm x 80 mm.

(2) label, 117 mm x 80 mm.

b. **Small.** The self-adhesive small label is nominally 50 mm x 40 mm and contains similar details to those on the large label.

Authorisation of Labels

11. Once the condition status of EO or component(s) has been established, authorised personnel are responsible for completing the label by inserting all necessary details and attaching it to the EO or component(s). The appropriate Condition Status Label may be affixed with the sentence authority, e.g. Form EO 100 Serial No.

12. When the condition status of EO or components changes, the labels are to be changed or removed to indicate the new status. Condition status labels are only to be removed and destroyed by personnel authorised to do so.

Procedure for the Use of Condition Status Labels

13. The use of Condition Status Labels is to be in accordance with the following procedure:

a. The label is to be authenticated using an authorised inspection work-mark.

b. The labels are to be attached in a manner that will not damage or deface the EO or obliterate identification marks or numbers.

c. The labels are to be attached to each ‘unit of issue’ of EO in such a manner as to be readily visible for inspection purposes when the materiel is placed in storage. The ‘unit of issue’ means a package, container, box, pallet, unit load, banded items or an individual item.

ANNEX B

d. Labels are to be attached in such a manner as to prevent loss or damage by placing them where they cannot be pulled or accidentally scraped off, or otherwise mutilated during handling.

e. The labels are to be attached to each 'unit of issue' of EO as soon as possible after reclassification of the stock is reported. At EO Storage Depots only, in the interest of economical stock management for large quantities of stock, placarding of multiple 'units of issue' with a single Condition Status Label is permissible. However, each 'unit of issue' must be labelled when stock is issued to any external unit.

f. When the labels are to be used to designate the condition of assembled rounds of guided weapons or their associated packages, all applicable information is to be recorded on the label by authorised personnel before it is affixed to the item. A permanent black marking pen is to be used to fill in information on the label.

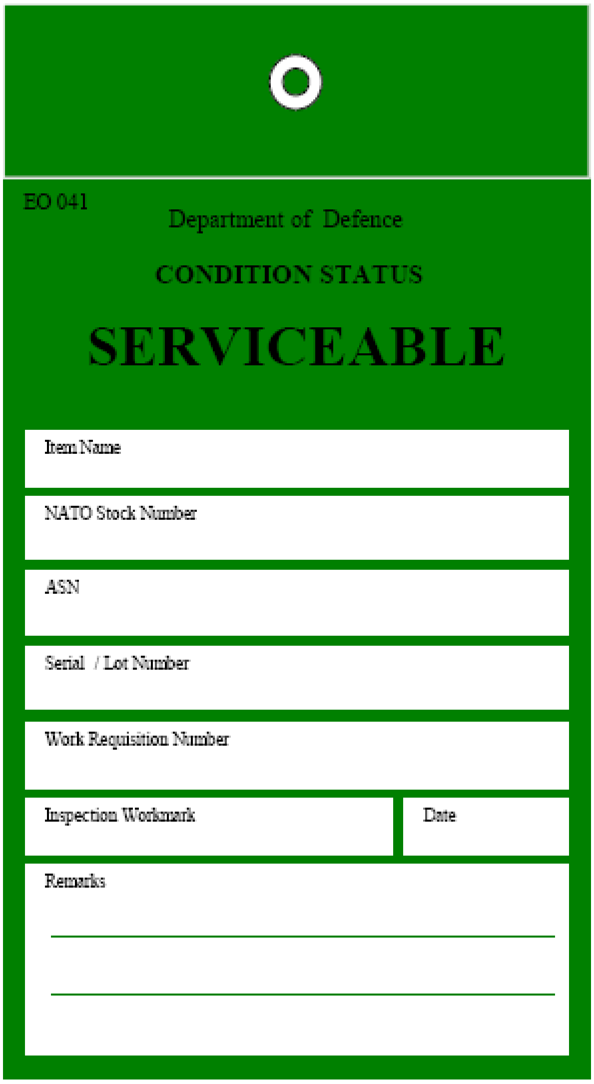
14. When the use of status labelling is not considered practicable, special dispensation of its use, for the particular circumstance, may be given by the relevant Item Manager provided the condition status of the materiel is readily identifiable by other markings on the package.

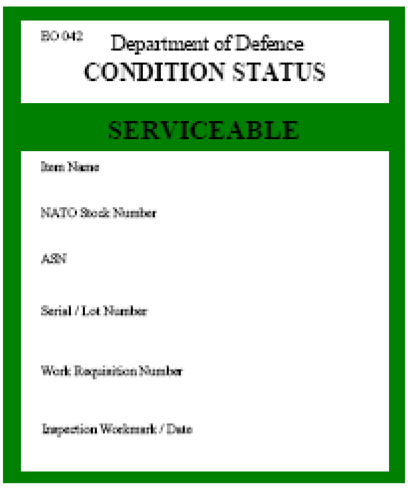
Appendix:
1. Specimens of Condition Status Labels

APPENDIX 1 TO ANNEX B

SPECIMENS OF CONDITION STATUS LABELS

SERVICABLE CONDITION STATUS LABEL

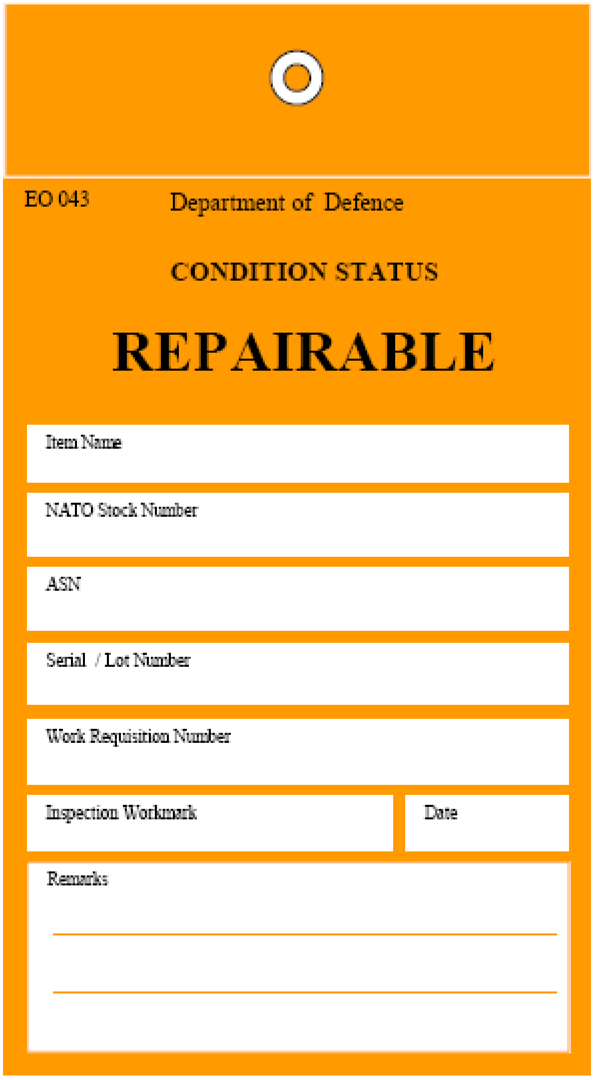


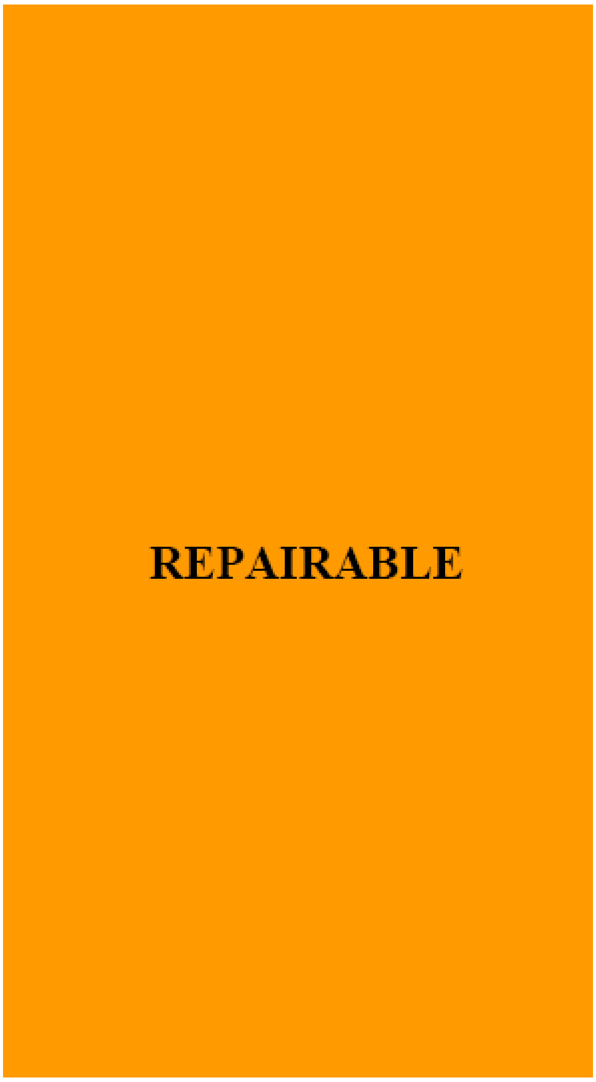


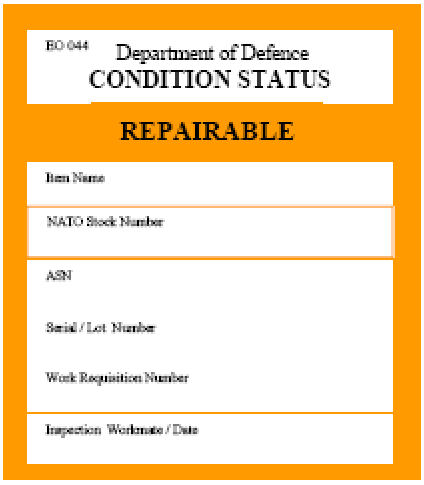
Distinguishing Colour:
GREEN

APPENDIX 1 TO ANNEX B

REPAIRABLE CONDITION STATUS LABEL



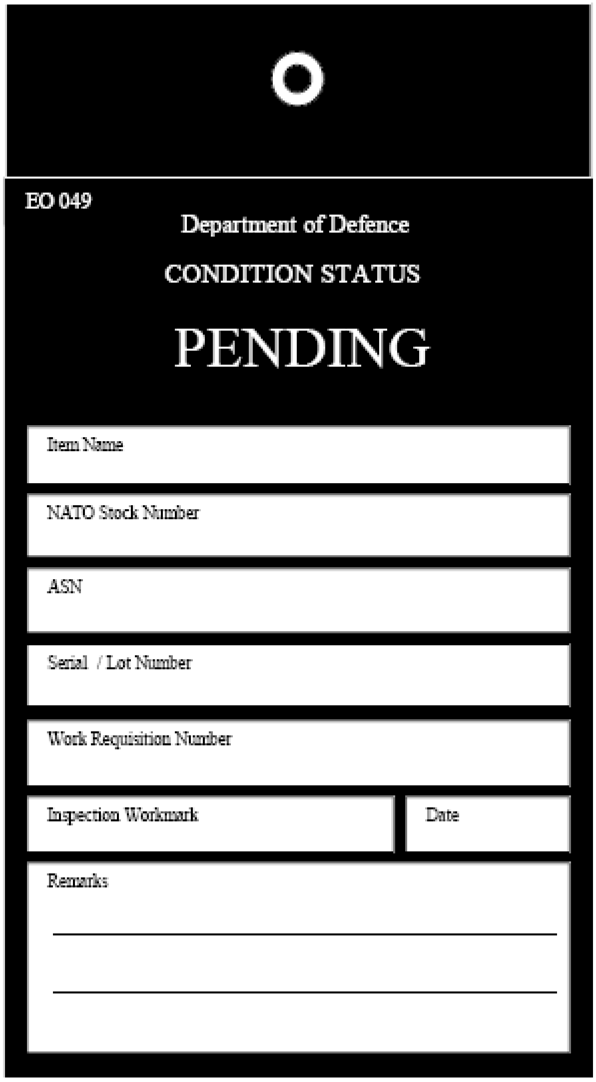




Distinguishing Colour:
YELLOW

**APPENDIX 1 TO
ANNEX B**

PENDING CONDITION STATUS LABEL



EO 049
Department of Defence
CONDITION STATUS
PENDING

Item Name

NATO Stock Number

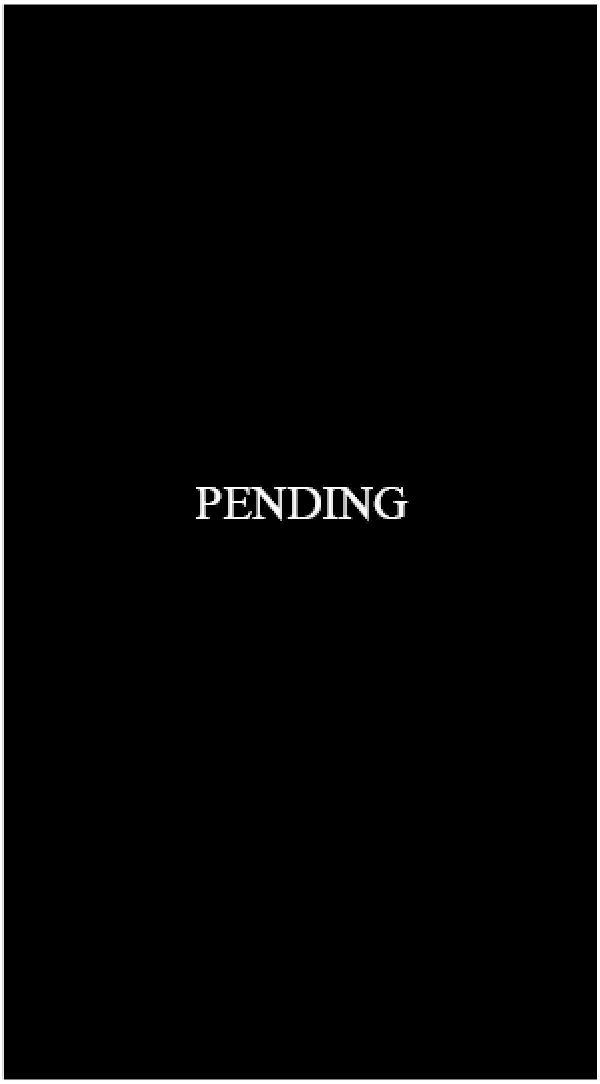
ASN

Serial / Lot Number

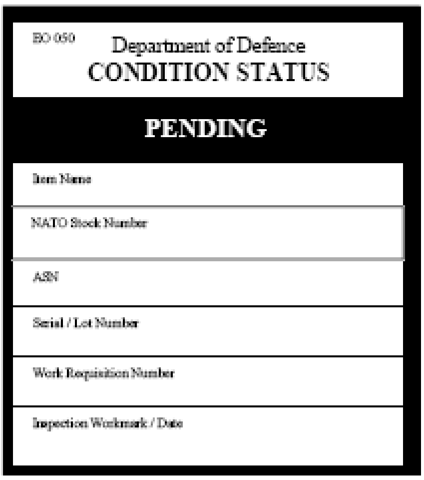
Work Requisition Number

Inspection Workmark | Date

Remarks



PENDING



EO 050
Department of Defence
CONDITION STATUS
PENDING

Item Name

NATO Stock Number

ASN

Serial / Lot Number

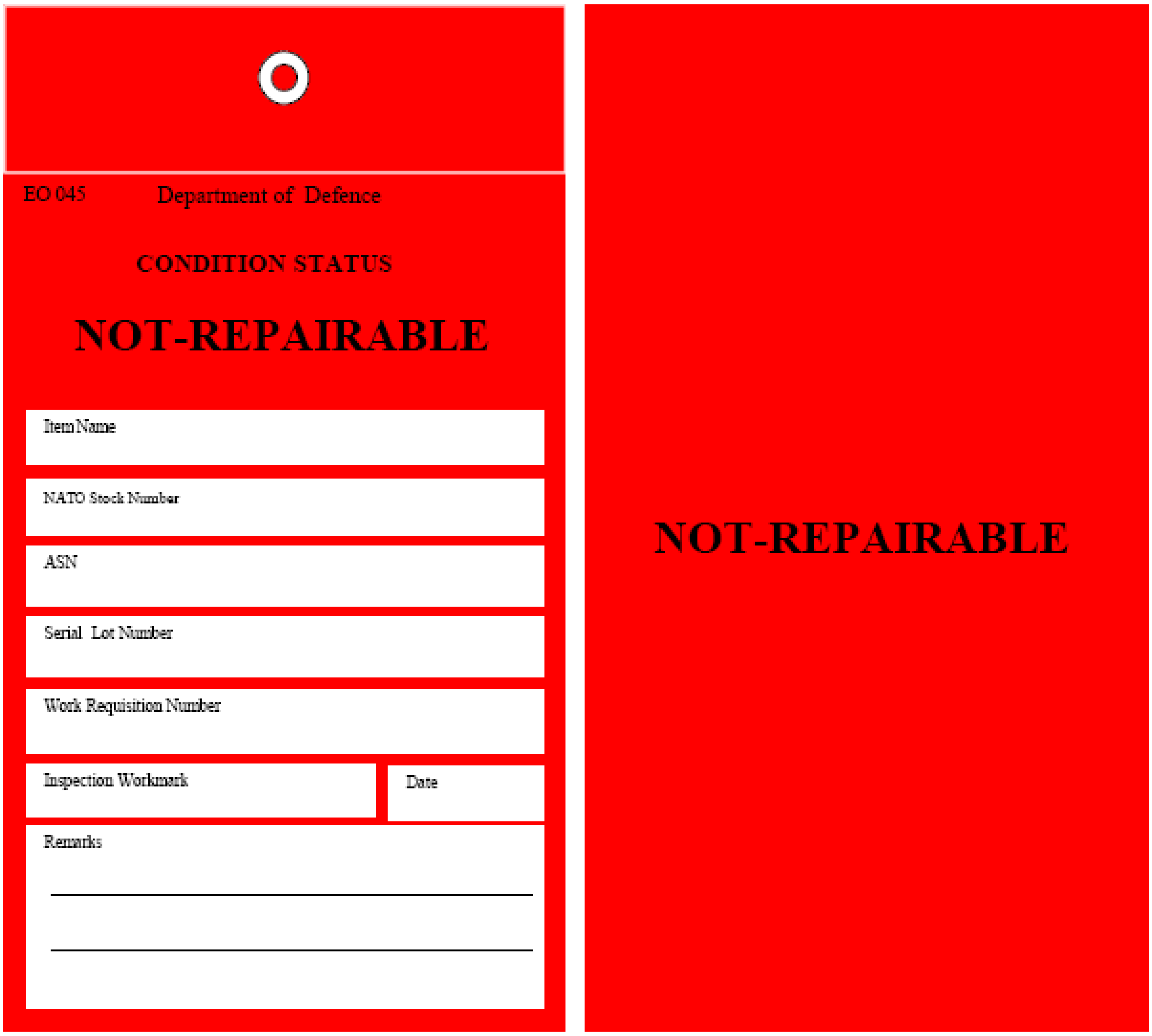
Work Requisition Number

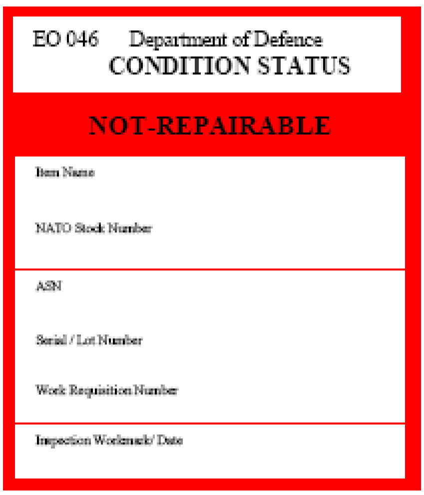
Inspection Workmark / Date

Distinguishing Colour:
BLACK

**APPENDIX 1 TO
ANNEX B**

NOT-REPAIRABLE CONDITION STATUS LABEL





Distinguishing Colour:
RED

**APPENDIX 1 TO
ANNEX B**

WARNING – DAMAGED STORE LABEL


WARNING

EO 047 Introduced Nov 2002

DAMAGED STORE

Part number | Type

Requirements *(Tick applicable boxes)*

Storage

☐ Normal ☐ Isolated

Transport and handling

☐ Normal ☐ Special

JALO contact

Certificate of safety number

Remarks

Stock No


WARNING

DAMAGED STORE

Part number | Type

Requirements *(Tick applicable boxes)*

Storage

☐ Normal ☐ Isolated

Transport and handling

☐ Normal ☐ Special

JALO contact

Certificate of safety number

Remarks

**Distinguishing Colour:
RED WITH DIAGONAL
STRIPES**

PROCEDURE 5 - HANDLING OF PACKAGES EMPTIED OF EXPLOSIVE ORDNANCE

Introduction

5.1 *Explosives Transport Regulations 2002 Statutory Rules No. 92* (ETR) specify that any package which has contained Explosive Ordnance (EO) is to be handled as an explosive item until it has been certified to be free from explosives material. Competent persons (see paragraphs 5.5 and 5.6) are required to examine such packages before certificates of 'Freedom from Explosives' may be issued. To give effect to the requirement of the ETR every empty EO package, if it bears labels or stencilled details which signify that it has contained explosives MUST BE SEALED with a label signifying it free from explosives or dangerous material.

Purpose

5.2 This procedure details the policy and procedures for inspection, sealing and certification of packages emptied of their contents of EO. In this procedure the term EO includes explosive articles, explosives substances, Non-Explosive Dangerous Goods (NEDG) and any associated chemical or flammable preparations.

5.3 The requirements of this procedure must not be confused with those of Regulation 2.3 Procedure 6 that deal with the return items of EO which have been functioned.

Applicability

5.4 The requirements of this procedure do not apply to EO packages of new manufacture that have not been put to use nor to packages that have been refurbished by an authorised agency and are 'clean skins'. These items may be handled as non-explosive items.

Appointments

5.5 Officers-in-Charge and Commanding Officers are to appoint and authorise personnel to examine and certify emptied EO packages Free From Explosives (FFE). The authorisation is to be promulgated in a local register such as unit Routine Orders (RO's) or the range or firing instruction for a particular activity.

Note

> The authorisation to certify EO packages FFE is distinctly separate to that of certifying Functioned EO as being FFE. Registers are to distinguish authorised personnel separately.

5.6 Authorisations are only to be given to persons who are assessed to be competent to examine and certify emptied EO packages as being FFE. The authorising officer is to ensure that all persons so authorised are conversant with this procedure.

'Certified Empty (Free From Explosives)' Label (Form EO 052)

5.7 EO packaging and containers are certified empty FFE when they are authenticity sealed with a completed 'Certified Empty (FFE)' Label (Form EO 052). The EO Service Provider is authorised to use either Form EO 052 or Thales Form FM-1.3.6-002 that has been approved for use within an Authorised Maintenance Organisation.

5.8 A specimen of the 'Certified Empty (FFE)' Label (Form EO 052) is given at Annex A.

Preparation and Affixing of 'Certified Empty (FFE)' Labels

5.9 The person who signs a 'Certified Empty (FFE)' Label accepts the responsibility for any package to which the completed label is affixed as being FFE. Therefore, only sufficient labels for immediate use should be prepared, and these should be properly safeguarded until they are affixed to packages or containers, to prevent their use by unauthorised persons.

5.10 To facilitate preparation rubber stamps may be used in advance for inserting the establishment monogram or designation and the date of examination. Labels must be signed in full - initials are not acceptable. Persons with Inspector Identification Code (IIC) stamps that have been issued and are accounted for in accordance with the requirements of Regulation 1.5 Procedure 2, may apply such IIC stamps in lieu of signing the label since the identification of the certifier can be determined.

5.11 Permanent black ink is to be used for stamped and handwritten markings.

Inspection and Sealing of Empty Packages

5.12 Every package on which it is indicated by an Explosives Class Label and other relevant details that it has contained EO, is to be examined to certify it FFE. If necessary non-permanent partitions, packing etc are to be removed. On completion of the internal examination, the examiner is to ensure all internal packing is replaced unless there are local instructions to the contrary. The package is closed and sealed in the following manner:

a. Legibly complete a ‘Certified Empty (FFE)’ Label by:

(1) inserting the establishment monogram or designation,

(2) inserting the name and full signature (or applying the IIC stamp) of the person who undertakes the task,

(3) inserting the date on which the task is completed, and

(4) striking out the ‘not applicable’ certification heading, eg

FREE FROM: EXPLOSIVE ORDNANCE

~~CONTAMINATION~~

b. Attach the ‘Certified Empty (FFE)’ Label across the lip of the package lid in such a manner that it would tear if the lid is opened. If necessary, a second label placed opposite the first should be used to ensure authenticity sealing of the package. Alternatively, a security seal can be used in conjunction with the label to ensure integrity of the sealing.

c. Obliterate package markings and labels that indicate explosives or other dangerous goods content ie Explosives Class Label and UN Number. Other logistical information may remain.

5.13 In order to eliminate needless breakage of ‘Certified Empty (FFE)’ Labels and the extra work involved in resealing the packages, wherever possible loose lids which may move during handling, eg on Boxes Projectile P72, should be secured by two diagonally opposite screws or some other suitable means.

5.14 ‘Certified Empty (FFE)’ Labels must remain on all empty packages until such times as the packages are refilled, refurbished and are ‘clean skins’ or put forward for disposal.

5.15 **Packages for Explosive Substances and NEDG.** Packages which have been emptied of explosive substances, NEDG and associated chemical or flammable preparations are to be examined for contamination and, where necessary, are to be decontaminated by an approved method before the packages are sealed. A completed ‘Certified Empty (FFE)’ Label indicating that the package is ‘Free from Contamination’ is to be use to seal the package. Packaging material that cannot be decontaminated is to be destroyed, under precautions, by burning if permitted by the appropriate local environmental protection agency. They are then to be certified as per paragraph 5.12.

5.16 Non-returnable Packages. Non-returnable packages that have been emptied are to be examined for freedom from explosives and then destroyed.

Uncertifiable Packages

5.17 Any package which, because of its construction, cannot be certified as FFE or Free From Contamination, is to be accounted for as an explosive item under its original hazard classification with all Explosives Class Labels intact and sealed in the normal manner.

Packages Containing Functioned Explosive Ordnance

5.18 Where a package that has contained EO is utilised for the return of functioned EO, the requirements detailed in Regulation 2.3 Procedure 6 are to be followed.

Examination of Packages Received from External Sources

5.19 Other Defence Establishments. Any packages received at a Defence EO Depot from other Defence Establishments and sealed with 'Certified Empty (FFE)' Labels may be accepted without further examination, provided the labels are intact.

5.20 Sources Other than Defence Establishments. All EO packages received at a Defence EO Depot from Government establishments may be accepted without further examination provided the 'Certified Empty (FFE)' Labels on the packages are intact.

5.21 Any packages received from any source with missing, broken, damaged or defaced 'Certified Empty (FFE)' Labels are to be re-examined and resealed with new labels by a person authorised to do so.

Examination of Empty Packages Before Issue from Defence Explosive Ordnance Depots

5.22 Internal Issues for Re-Use or Repair. All packages certified FFE before being issued internally for repair or re-use are to be checked before being taken from their place of storage and if found with missing, broken, defaced or damaged 'Certified Empty (FFE)' Labels are to be examined and resealed.

5.23 Issues to another Defence Explosive Ordnance Depot. Any packages before being issued to another Defence EO Depot are to be checked as required at paragraph 5.22 for internal issues. The instruction at paragraph 5.27 also applies.

5.24 Issues to the Explosive Ordnance Services Providers. The following requirements apply to issues of packages to the EO Services Providers:

a. Packages are to be checked as required at paragraph 5.22 for internal issues.

b. Explosives Class Labels, UN Numbers or other dangerous goods labels must be removed or defaced before issue.

c. The instruction at paragraph 5.27 is to apply.

5.25 Issues for Disposal by Sale. All packages, packing pieces and any other items which have been in contact with EO, before being issued for disposal by sale must be examined or re-examined, as appropriate, even if the packages have intact 'Certified Empty (FFE)' Labels, to ensure that they are FFE or free from other dangerous or flammable material. The packages are to be resealed with 'Certified Empty (FFE)' Labels. The instruction at paragraph 5.27 also applies.

5.26 Disposal in Depot. Packages for disposal on location in the Depot concerned are to be checked as required at paragraph 5.25 for external sales but the packages need not be resealed with 'Certified Empty (FFE)' Labels. The examination may be carried out at the destruction site, but at a safe distance from the destruction point.

Transport of Empty Packages

5.27 Empty EO packages are not to be transported unless they have been certified Free from Explosives (FFE) or Free From Contamination in accordance with this procedure. If there is a need to transport packages that have not been so certified, they are to be transported as if they contained EO under its original hazard classification, with the exception of Regulation 2.3 Procedure 6, paragraph 15.

5.28 When empty packages are to be transported, they are to be correctly stacked and secured so as to prevent unnecessary damage. Prior to loading for transportation, all empty packages for EO are to be re-checked to ensure correct certification.

Annotation of Transport Consignment Documentation

5.29 Whenever empty EO packages that have been certified empty FFE are to be transported, consignment documents are to be annotated to indicate that the packages are empty FFE.

Storage of Certified Empty Packages

5.30 Sealed empty packages are to be segregated from other unsealed packages and care is to be taken that they do not constitute a fire hazard.

5.31 Empty packages are to be stored under the best available conditions to retain them in a serviceable state. Stocks of empty packages are to undergo a routine inspection to determine that the packages are not deteriorating in storage where the packaging has not, within the previous two years:

a. undergone refurbishment, or

b. been inspected, or

c. been utilised for packaging EO.

5.32 Empty packages are not to be stored in an EO building together with EO without the written authority of the Officer-in-Charge. When necessary they may be stored within an EO area in a place set aside for the purpose.

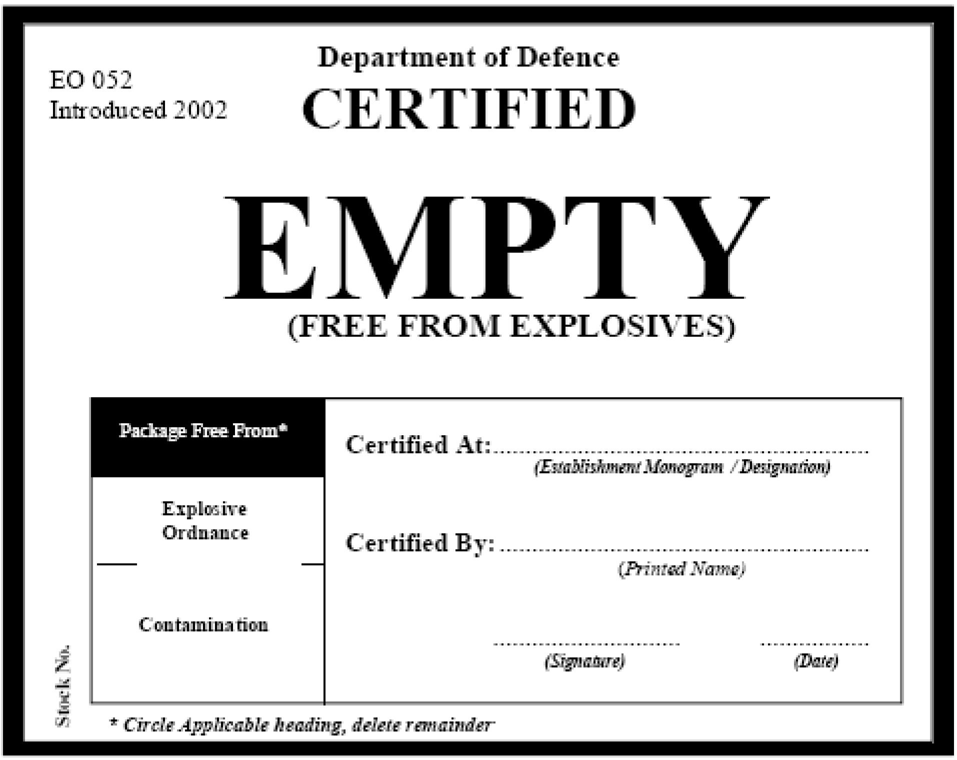
5.33 Packages that have been certified in accordance with this procedure are to be stacked separately from those empty packages which have not been so certified and are awaiting certification.

5.34 Care is to be taken to ensure empty packages in storage do not constitute a fire hazard.

Annex:
A. Sealing Label for Empty Explosive Ordnance Packages Form EO 052 'Certified Empty (Free From Explosives)' Label

ANNEX A

SEALING LABEL FOR EMPTY EXPLOSIVE ORDNANCE PACKAGES FORM EO 052 'CERTIFIED EMPTY (FREE FROM EXPLOSIVES)' LABEL



EO 052
Introduced 2002

Department of Defence
CERTIFIED

EMPTY

(FREE FROM EXPLOSIVES)

Package Free From*	Certified At:..
	(Establishment Monogram / Designation)
Explosive Ordnance	Certified By: ....
	(Printed Name)
Contamination	....
	(Signature) *(Date)*

Stock No.

** Circle Applicable heading, delete remainder*

PROCEDURE 6 - HANDLING OF FUNCTIONED EXPLOSIVE ORDNANCE FOR SALVAGE AND RETURN

Introduction

6.1 Metal cases of functioned cartridges are to be salvaged and returned for recycling.

6.2 Environmental considerations require the recovery and return for disposal of some functioned Explosive Ordnance (EO) which present a hazard, e.g. Marker Man-Overboard (MMOB) fitted with lithium batteries. Some functioned EO, e.g. Navy Saluting Cartridges, are required to be returned to Defence EO depots for refurbishment.

6.3 In each of these instances the package in which the functioned EO is returned by users, is to bear a label signifying that it contains an item which is Free From Explosives (FFE), or that the item is certified safe for transportation.

Purpose

6.4 This procedure details the requirements for the return of functioned EO as salvage/produce, for disposal or other actions e.g. refurbishment. In this procedure the term explosive ordnance includes explosive articles, explosive substances, Non-Explosive Dangerous Goods (NEDG) and any associated chemical or flammable preparations.

6.5 The requirements of this procedure must not be confused with those of Regulation 2.3 Procedure 5 that deal with empty EO packages that can be certified EMPTY (Free from Explosives).

Appointments

6.6 Officers-in-Charge (OIC) and Commanding Officers (CO) are to appoint and authorise persons in writing to examine and certify functioned EO as being FFE. A local register, such as Routine Orders (RO) or the range or firing instruction for a particular activity, of such appointments/authorisations is to be retained.

Note

The authorisation to certify Functioned EO is distinctly separate to that of certifying packages FFE. Registers such as RO are to distinguish authorised personnel separately.

6.7 Authorisations are only to be given to persons who are assessed to be competent to examine and certify functioned EO as being FFE. The authorising officer is to ensure that all persons so authorised are conversant with this procedure.

6.8 No person is to certify any functioned EO as FFE when not so authorised in writing.

SALVAGE/RETURN Label (Form EO 051)

6.9 When packages are used to return complete or components of functioned EO as salvage, for disposal or refurbishment, completed SALVAGE/RETURN Labels (Form EO 051) are to be used to seal and/or show the contents of the packages by generic description, as appropriate.

6.10 A specimen of the SALVAGE/RETURN Label (Form EO 051) is given at Annex A.

Preparation and Affixing of SALVAGE/RETURN Label

6.11 The person who signs a SALVAGE/RETURN Label accepts the responsibility for certifying that a package to which the completed label is affixed, contains functioned EO that is FFE. Therefore, only sufficient labels for immediate use should be prepared, and these should be properly safeguarded until they are affixed to packages or containers, to prevent their use by unauthorised persons.

6.12 To facilitate preparation rubber stamps may be used in advance for inserting the establishment monogram or designation and the date of examination. Labels must be signed in full - initials are not acceptable. Personnel with workmark stamps that have been issued and are accounted for in accordance with the requirements of Regulation 1.5 Procedure 2, may apply such workmarks in lieu of signing the label since the identification of the certifier can be determined.

6.13 Permanent black ink is to be used for stamped and handwritten markings.

Examination, Packaging and Marking of Salvage

6.14 The following is to apply when functioned EO is returned as salvage:

a. When a package that has previously held EO is used, it is to be examined to ensure that it contains no live EO. Obliterate all package markings and labels which indicate explosive content e.g. Explosives Class Label and UN Number. Other logistical information may remain. Each functioned item is to be carefully examined to ensure that no live EO is included. A completed SALVAGE/RETURN Label is to be firmly affixed to the package. The word 'RETURN' is to be crossed out. The label is to be used to seal the container and signed by the authorised person responsible for the task.

b. When a package is used, other than one that has contained EO, e.g. a sandbag, a completed SALVAGE/RETURN Label is to be affixed to the package. The word 'RETURN' is to be crossed out. Where possible the label is to act as a seal. The label is to be signed by the authorised person responsible for the task.

c. Unpackaged large and medium calibre cartridge cases, e.g. 105 mm HOW, 5in/54, 76 mm, 30 mm, 25 mm projectiles, 40 mm Low Velocity and High Velocity grenades, and small arms cartridges larger than 12 mm, being returned as salvage, are to be examined to ensure that they have functioned. When being returned in large quantities the cases may be packed into large containers e.g. post pallet, with one completed Salvage/Return label attached to signify that the pallet is FFE and giving the content and quantity of empty cases. The word 'RETURN' is to be crossed out. The label is to be signed by the authorised person responsible for the task. Steel strapping or other suitable methods should be used to secure the doors of post pallets.

Storage, Transportation and Handling of Small Arms Ammunition Salvage (up to 12 mm Calibre)

6.15 Small Arms Ammunition (SAA) salvage/produce resulting from range practices, that has been sorted (from live SAA) at the collection or firing point but has not been certified FFE may be transported and handled as non-explosive. This only applies to SAA up to 12 mm. However, such salvage/produce should not be taken into occupied facilities until certified FFE. When it is necessary to return range produce/salvage and empty ammunition boxes before they are certified FFE, and live or defective rounds of SAA to non-explosives facilities at the unit, they are to be stored as follows:

a. Storage of range produce/salvage and empty ammunition boxes is to be in a fenced or secure area which is not normally occupied. If only a portion of the area is to be used for that purpose, the storage area is to be delineated with red painted lines;

b. Fire division and supplementary fire signs, as appropriate, are to be displayed at the storage area until the produce/salvage and empty boxes have been certified FFE;

c. Items not certified FFE may be stored in the area only for a maximum of 72 hours before they are to be moved to the explosives area; and

d. Live or defective rounds of SAA are to be stored in licensed small quantity facilities or where licensed storage is unavailable; they should be passed to the Joint Explosive Ordnance Services (JEOS) of the local Joint Logistics Unit (JLU) for disposal.

Note

SAA of 12.7 mm or 50 CALIBRE may contain explosive or incendiary components. Such rounds are not included in the SAA category.

Examination, Packaging and Marking of Returns

6.16 When a Functioned item is to be returned for other than salvage purposes e.g. disposal or refurbishment, it is to be visually examined to confirm its status, packed and marked as follows:

a. Where there is no indication the item is continuing to function and it is evident that the explosive content has been fully consumed it is to be treated in accordance with paragraph 6.14a with the word ‘Return’ circled and the word ‘SALVAGE’ crossed out on the SALVAGE/RETURN label.

b. Where there is no indication the item is continuing to function but cannot be inspected to the extent necessary to verify that the explosive content is fully consumed, e.g. MMOB, or the authorised inspector is not familiar with the item, the item is to be treated as suspect EO and a Certificate of Safety raised in accordance with Regulation 3.1 Procedure 2. The item is to be placed in a robust metal box with the appropriate prescribed markings. In addition the box is to be clearly marked to indicate that it contains Functioned EO that cannot be certified. As a safety measure in the event of re-ignition, the store is to be segregated when practicable from other EO during storage and transportation. If the safety of any store during handling or transport is in doubt, the store is to be dealt with by appropriately qualified Explosive Ordnance Disposal (EOD) staff. Contact JEOS for assistance.

Disposal

6.17 When EO is disposed of by burning and the residue is of sufficient quantity, it is to be collected and treated in the same manner as required in sub-paragraph 6.14 a or b.

Functioned Explosive Ordnance required for Instructional Purposes

6.18 Functioned EO may be used for instructional purposes provided the EO is cleaned, inspected, certified, marked and registered as Inert in accordance with the procedures in Regulation 2.4.

Live Explosive Ordnance Returned with Salvage

Note

This procedure does not apply to Unexploded Ordnances (UXO) which is not normally handled. UXO is to be dealt with in accordance with approved disposal procedures. Contact JEOS for assistance in this circumstance.

6.19 **Live EO and Salvage.** If for whatever reason live EO, whether Serviceable or not, is returned together with salvage/produce, the live EO of each serviceability status and salvage are each to be packaged separately and returned on separate issue vouchers.

6.20 **Serviceable EO.** The voucher for the live EO that is Serviceable is to be certified ‘Free from Misfires and in an Unarmed State’ and signed by the authorised and competent individual. Every effort is to be made to ensure that EO is returned in original containers with seals intact.

6.21 **Defective, Damaged, Malfunctioned or Misfired EO.** If defective, damaged, malfunctioned or misfired EO is required to be returned for defect investigation or the like, the EO is to be kept strictly separate from Serviceable EO and salvage, and returned on a separate issue voucher annotated accordingly. In such cases, to certify the EO safe for handling and transport, the following requirements are to be followed:

a. Regulation 3.1 Procedure 2 – Certificate of Safety,

b. Regulation 2.3 Procedure 2 – Packing and Unpacking of Explosive Ordnance,

c. Regulation 2.3 Procedure 3 – Closing and Sealing of Packages;

d. Regulation 2.3 Procedure 4 – Marking and Labelling of Explosive Ordnance Packages.

6.22 Packaging for Salvage. Sandbags may be used to return salvage, e.g. expended SAA cartridge cases. However, under no circumstances is live EO, in particular live SAA, to be placed into or returned in sandbags. Live SAA must be packed in accordance with authorised packaging arrangements and sealed with authenticity seals in accordance with Regulation 2.3 Procedure 3.

Annex:
A. SALVAGE/RETURN Label for Functioned Explosive Ordnance - Form EO 051

ANNEX A

SALVAGE/RETURN LABEL FOR FUNCTIONED EXPLOSIVE ORDNANCE - FORM EO 051

EO 051
Introduced 2002

Department of Defence

SALVAGE/RETURN*

Certification that the package contains functioned Explosive Ordnance and is FREE FROM EXPLOSIVE	Certified At: .... (Establishment Monogram / Designation) Certified By: .... (Printed Name) .... (Signature) (Date)

Contents of Package	....	Qty: ....

Stock No

* Circle applicable heading, cross out remainder

PROCEDURE 07 - UNIT LOADS AND FREIGHT CONTAINERS

Introduction

7.1 A Unit Load (UL), is defined as a number of packages or loose items (in or out of containers made up into one load. which because of its size and mass must be handled mechanically. A UL may consist of the same item or a compatible group of items.

7.2 ULs are classified as OVERPACKS under UN Model Regulations Recommendations on the Transport of Dangerous Goods—Model Regulations, ST/SG/AC.10/1 (Orange Book). Overpacks are defined as an enclosure used by a single consignor to contain one or more packages and to form one unit for convenience of handling and stowage during transport. Examples of overpacks are a number of packages either:

a. Placed or stacked on to a load board such as a pallet and secured by strapping, shrink wrapping, stretch wrapping, or other suitable means; or

b. Placed in a protective outer packaging such as a box or crate.

7.3 A Unit Load Special Purpose (ULSP), is a configuration that exceeds the parameters of a normal UL or requires the use of two pallets fixed together to accommodate the item or required for specialised roles e.g. replenishment by helicopter as underslung loads, loads designed for air dropping etc. For the purposes of this procedure ULSPs will be included as ULs.

7.4 Freight container means an article of transport equipment that is of a permanent character and accordingly strong enough to be suitable for repeated use; specially designed to facilitate the transport of goods, by one or more modes of transport, without intermediate reloading; designed to be secured and/or readily handled, having fittings for these purposes, and approved in accordance with the International Convention for Safe Containers (CSC), 1972, as amended. The term “freight container” includes neither vehicle nor packaging. However, a freight container that is carried on a chassis is included. For the purpose of this Code it also means a re-usable container of the kind mentioned in AS/NZS 3711 that is designed for repeated use for the transport of goods by one or more modes of transport however, such a container will not be accepted for sea transport unless it complies with the CSC.

References

7.5 The references below provide a guide to the construction of ULs. It should be noted that standard pallet sizes and weights may vary from country to country. The following references should be used with the AE Code or the applicable Competent Authority document when developing ULs:

a. **DEF AUST 1000C Part 11.** Whilst DEF Aust 1000C is not applicable to EO, it should be consulted for the definitions and preferred dimensions for palletisation within the Australian Defence Organisation (ADO). The standard is available from Capability Acquisition and Sustainment Group (CASG).

b. **STANAG 2828.** STANAG 2828 is the standardisation agreement that defines the standard UL used by NATO member countries.

c. **UN Recommendations on the Transport of Dangerous Goods – Model Regulations ST/SG/AC.10/1 (Orange Book)**.

Purpose

7.6 This procedure provides guidance on the principles and processes for the:

a. Development, preparation and approval of ULs.

b. Marking of ULs.

Requirements

7.7 The EO procurement organisation is to establish procedures for approving ULs within their Engineering Management System (EMS) for items entering the Defence supply system from the OEM.

7.8 Individual Services, Agencies and Groups are to establish procedures for approving ULs that may differ from the original configuration or are prepared for specialist roles. This includes mixed ULs for delivery to and from the user, ULs prepared for transfer at sea etc.

7.9 ULs may only be formed with packages that have a valid UN Package Marking Code (UNPMC).

7.10 **Items of EO prepared as a UL for air drop**. The EO procurement organisation is responsible to determine the expected suitability for an item to be air dropped based on design. Authorisation for UL configurations is the responsibility of Air Mobility Training and Development Unit (AMTDU).

7.11 Individual Services are responsible for notifying the responsible EO procurement agency and the EO service provider of any restrictions that apply to the provision of a standard UL.

7.12 STANAG 2828 may be used as a guide in the preparation and testing of ULs as far as they are compatible with Australian Defence equipment and logistic requirements.

Marking of unit loads

7.13 The marking of ULs is to be IAW the Australian Code for the Transport of Explosives by Road and Rail (AE Code) or the appropriate Competent Authority requirement. Where deemed necessary for a UL, a Unit Load form (The preferred UL form for Defence is at Annex A) is to be used convey the mandatory marking required by the AE Code.

GUIDANCE

General requirements for unit loads

7.14 ULs should be designed, as far as practicable, to be moved without restriction throughout the distribution system and should be compatible with:

a. Existing air, sea, rail, and road transport systems.

b. Handling equipment used throughout the expected logistics flow patterns.

7.15 The choice of pallet will depend partly on the size, shape, weight and number of the packages comprising the unit load. The pattern of packages on the pallet should make the most efficient use of the space and voids should be kept to a minimum. Where voids cannot be eliminated, they should be filled with wooden formers unless the palletising pattern and package sizes are such that the load is stable and will not distort in transit.

7.16 The pattern should also fill the pallet plan dimensions. If there is more than 20 mm under-hang on any side, battens or spacers should be used to make the effective size of the load equal to the pallet plan dimensions. This will improve stacking stability and ensure that adjacent unit loads support each other during transport.

7.17 Alternate layers of packages should interlock if possible. For example, if packages are arranged in a spiral or pinwheel pattern, alternate layers should be arranged in opposite directions. The top layer of packages should provide a level and stable surface for stacking purposes. If necessary, packing pieces or a cap may be used to achieve this.

7.18 The maximum stacking height for the UL will be limited by stability considerations and, possibly, the strength of the individual packages on the bottom layer of the bottom pallet. The nature of the EO in the unit load and the type of pallet may impose additional limitations on the stacking height (see Regulation 4.1 Procedure 8).

7.19 Any Timber materials used in the construction of a UL (including the pallet base) should be ISPM 15 compliant to allow for import and export requirements.

7.20 Steel Strapping that has not been previously used and in a continuous length, to form a secure band should be used. The size of the Steel Strapping is to be IAW STANAG 2828. Preferably no other strapping or wrapping material other than steel is to be used.

7.21 The published references in this procedure should be consulted for details of the various forms of UL furniture and its use in the construction of a UL.

Partial unit loads

7.22 A partial UL is one which contains fewer items than specified for the type of store and consists of one or more complete layers of items or packages. Partly filled layers are prohibited. Quantities of items or packages less than one full layer or in excess of one or more full layers are to be stored, transported and handled as individual items or packages.

7.23 Fraction labels/stencilling will be required to be added to the unit load forms for partial ULs.

7.24 Partial ULs are to be assembled as specified for the type of store except for the height (number of layers). Any edge battens or frames filling any voids should be reduced in height to suit the number of layers being assembled.

7.25 Under no circumstances can part or fraction palletised loads have voids filled with empty packages to produce an even top tier or to complete a horizontal layer.

Annex:

A. Unit load forms

ANNEX A

UNIT LOAD FORMS

Introduction

1. Explosive Ordnance (EO) is, as far as practicable, to be bulk stored in unit loads, consisting of packaged stores assembled in suitable quantities for convenient handling by materials handling equipment such as fork lift trucks. Unit Load Specifications (ULS) define the composition, method of assembly and intended use of unit loads. ULS may cover individual stores or a number of specified similar types of stores. Irrespective of the stores grouped together, the unit load contents require their identification details to be displayed. Unit load forms enable stock verification, stocktaking or other similar functions.

Purpose

2. This procedure prescribes the requirements for, and the use of, the following unit load forms:

a. Unit Load Contents Record (GI 050); and

b. Unit Load Placard (Form GI 049).

Unit Load Contents Record (Form GI 050)

3. The Unit Load Contents Record - Form GI 050[1] (see specimen at Figure 1A-1) is to be displayed on individual unit loads of EO to provide essentially, lot and quantity details for the contents of the unit load.

4. When a unit load of EO is assembled, a Unit Load Contents Record is to be prepared by the supervisor responsible for its assembly, and securely attached to the unit load. The record is not to be removed until the unit load is dismantled, at which time it is to be destroyed.

5. At EO Storage Depots only, in the interest of economic management for large quantities of stock, placarding of multiple ’units of issue’ with unit load contents details is permissible. However, each ’unit of issue’ must be labelled separately when stock is issued to any external unit.

6. The Unit Load Contents Record is available on Webforms.

Unit Load Placard (Form GI 049)

7. The Unit Load Placard - Form GI 049[1] (see specimen at Figure 1A-2) is to be displayed on individual loads of EO to provide EO transportation and storage information.

8. When a unit load of EO is assembled, Unit Load Placards are to be prepared by the supervisor responsible for its assembly, placed in a plastic envelope and securely attached to opposite sides of the unit load with one of those sides the same side as where the Unit Load Contents Record is attached. If each and every package of the unit load is marked in accordance with Regulation 2.3 Procedure 4 and the markings on the outer packages in the unit load are clearly visible and are not obscured by any wrapping material, then the Unit Load Placard needs only to be attached to the same side as the Unit Load Contents Record. The placard is not to be removed until the load is dismantled.

9. When multiple unit loads comprise one stack, the Unit Load Placard and Unit Load Contents Record for each unit load is to be positioned so that it is readily visible to enable stock verification, stocktaking or other similar functions.

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[1] Commercial EO Services Providers may substitute an equivalent internal form.

ANNEX A

10. At EO Storage Depots only, in the interest of economic management for large quantities of stock, placarding of multiple 'units of issue' is permissible. However, each 'unit of issue' must be labelled separately when stock is issued to any external unit.

11. The NATO Stock Number (NSN) used to order Form GI 049 is 7530-66-138-6445.

ANNEX A

GI 050
Revised 28 Nov 2011

Department of Defence

Unit Load Contents Record

Unit load details

UL specified reference	Requisition number *(If applicable)*
Assembled at *(Establishment monogram)*	Date Assembled

Assembled by

Signature		Printed name
Rank or appointment	Telephone number	

Contents details

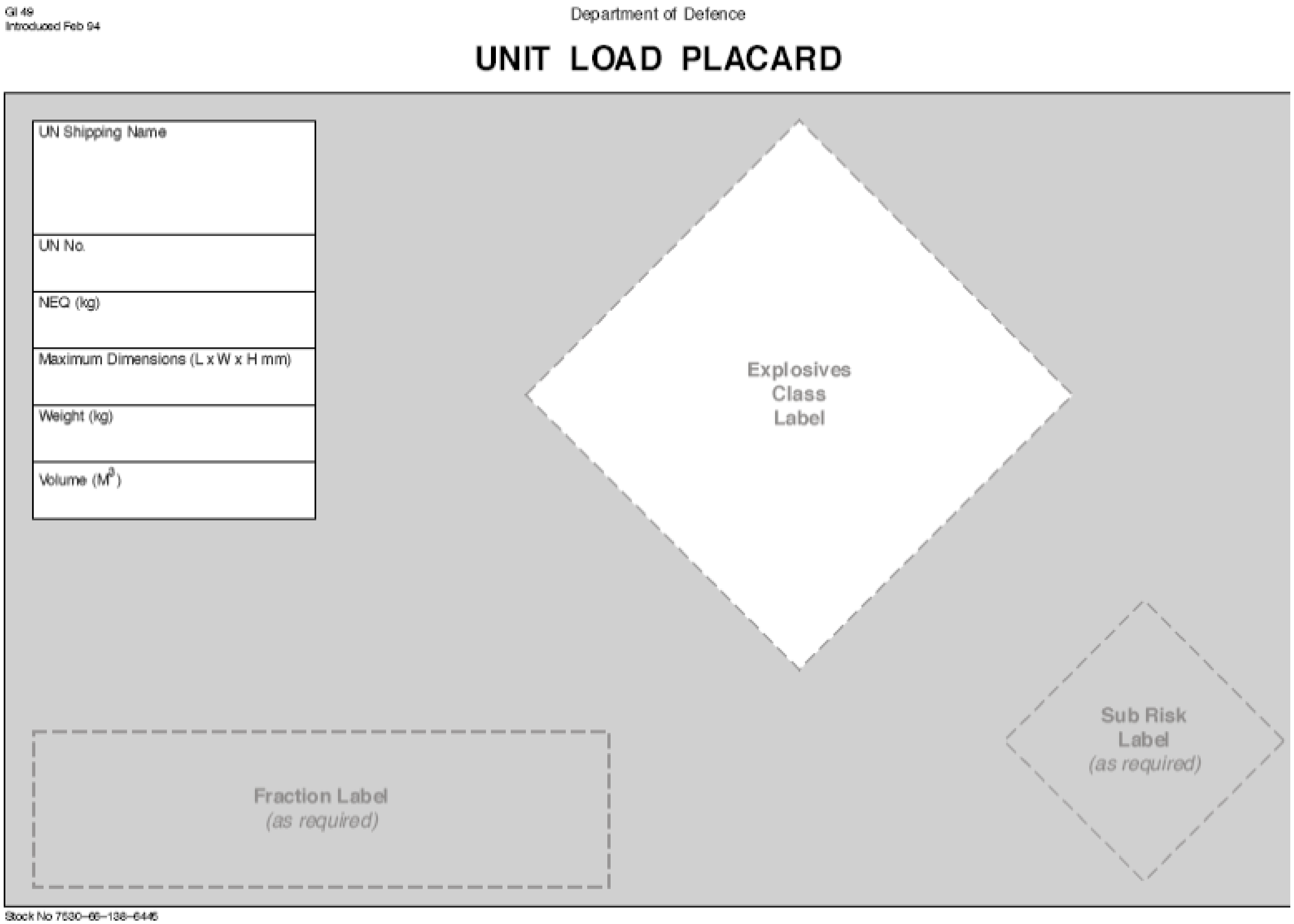
UN shipping name	Stock number
Short item name	
Total quantity *(comprising list below)*	

Lot or serial number details	Quantity	Lot or serial number details	Quantity

Stock No 7530-66-138-6406

Figure 1A-1 – Specimen of Unit Load Contents Record (Form GI 050)

ANNEX A



GI 49
Introduced Feb 94

Department of Defence

UNIT LOAD PLACARD

UN Shipping Name

UN No.

NEQ (kg)

Maximum Dimensions (L x W x H mm)

Weight (kg)

Volume (M^3)

Explosives
Class
Label

Sub Risk
Label
(as required)

Fraction Label
(as required)

Stock No 7530-66-138-6446

Figure 1A-2 – Specimen of Unit Load Placard (Form GI 049)

REGULATION 2.4 – INERT EXPLOSIVE ORDNANCE SAFETY

Regulation 2.4: (Intent) Inert Explosive Ordnance must be managed to control personal safety risks.

Introduction

4.1 Defence establishments and units may hold inert Explosive Ordnance (EO) for the purposes of training, display, and research. Items of inert EO are required to be:

a. Inspected by competent and authorised personnel to verify their status, determine the process for managing any safety risks and accountability requirements, and communicate these requirements.

b. Managed by units to control safety risks.

Related Publications

4.2 The following publications are related with this regulation:

a. DEFLOGMAN Part 2 Volume 9 Defence Explosive Ordnance.

b. DEFLOGMAN Part 2 Volume 8 Chapter 8 - Appropriation and Import of non-Australian Defence related Materiel during Australian Defence Force Operations.

c. Electronic Supply Chain Manual (ESCM) V04S08C01K – Management and Accounting of Inert Explosive Ordnance.

d. Defence Security Principles Framework (DSPF) Principle 79, Control 79.1 Annex C.

Applicability

4.3 This regulation provides direction for personnel involved in the processing and management of inert EO, or EO that is intended for inerting for Defence purposes. Defence is not responsible, and must not participate in, inerting EO for individuals or organisations external to Defence.

4.4 This regulation is not applicable to:

a. Drill, dummy, inert/instructional EO or ammunition that has been originally manufactured in an inert state for the specific purpose of operations, training or display. Items in these categories must be appropriately catalogued, codified and marked inert.

b. EO that requires a certificate of safety for transport in accordance with Regulation 3.1 Procedure 2 – Certificate of Safety.

c. Items that result from range activities that are considered range produce as described in Regulation 2.3 Procedure 6 - Handling of Functioned Explosive Ordnance for Salvage and Return.

4.5 **In-Service EO**. Items of In-Service EO are not to be made inert without the approval of the relevant Service Capability Manager and the relevant EO management agency within Capability Acquisition and Sustainment Group (CASG). CASG should be requested in the first instance to acquire inert instructional aides for In-Service EO before considering inerting live EO for any purpose.

4.6 **Range Produce**. EO that has been fired, functioned, expended or subject to EOD is not normally to be recovered for use as a training aid or a display item. Such EO may be recovered and retained provided formal approval is granted as provided for in DEFLOGMAN Part 2 Volume 9 Chapter 6– Management of Inert EO, and the EO is rendered inert and inspected in accordance with this regulation.

REQUIREMENTS

Responsibilities

4.7 **Explosive Ordnance Safety Regulator**. The EOSR may authorise organisations to render

EO inert and inspect and certify EO as inert within Australia where they comply with the requirements of this regulation.

4.8 **Authorised Inerting Organisations**. The Commanding Officers or Managers of Authorised Inerting Organisations are responsible for:

a. Applying to the EOSR for authorisation as an Inerting Organisation detailing their processes for inerting EO as required at 4.13.

b. The safe conduct of inerting EO and the certification of inert EO in accordance with their authorisation.

c. Resubmitting to EOSR authorisation at intervals as specified by the EOSR.

4.9 **Chief of Joint Operations**. Where the requirement to breakdown EO, render EO inert or inspect and certify inert EO exists in declared Areas of Operations, the Chief of Joint Operations is responsible for authorisation of personnel and the establishment and approval of any attendant procedures in accordance with this regulation and DEFLOGMAN Part 2 Volume 8 Chapter 8.

4.10 **Commanding Officers and Supervisors**. Commanding Officers and supervisors are responsible for the safe management and registration of inert EO within their units and organisations, including the implementation of any controls advised by an Authorised Inerting Organisation. Commanding Officers and supervisors are responsible for ensuring that uncertified inert EO is not held within their organisation.

Requests to Render Explosive Ordnance Inert

4.11 All requests to render EO inert and/or inspect presumed inert EO are to be raised by the unit requesting officer. The originating unit is to complete the relevant sections of Form EO 039 – *Application to Inspect and Certify or Render Explosive Ordnance Inert* and forward it to an authorised organisation for consideration.

4.12 Acceptance of Rendering Explosive Ordnance Inert requests are at the discretion of the authorised organisation. Should an authorised organisation deem the item submitted for rendering as unsafe to render, the authorised organisation retains the discretion to destroy the item submitted for rendering.

Processes for Inerting Explosive Ordnance

4.13 Authorised Inerting Organisations must have suitable processes for the management and conduct of inerting explosive ordnance, including:

a. Training, Assessment and Authorisation of personnel to breakdown EO and render EO inert.

b. Training, Assessment and Authorisation of personnel to inspect and certify inert EO.

c. Inspectors are to have an unique work-mark and establishments are to have an unique monogram.

d. Verification of requirement from Capability Manager for Requesting Unit to hold inert EO as per DEFLOGMAN Part 2 Vol 9 Chapter 6.

e. Develop and implement risk control processes and procedures for the inerting of EO to ensure personnel safety risks are managed.

f. Personnel authorised to breakdown EO or render EO inert in accordance with Regulation 2.4 are not permitted to inspect and certify EO that they have rendered inert. Independent inspection is necessary.

g. Include provisions for safe cessation of inerting activities and disposal of items should it be identified that items become unsafe for inerting either before or during the inerting process.

h. Marking of inerted items:

- Engraved or indelibly stamped (or stencilled only when it is impracticable to engrave or stamp), as appropriate, with the word 'INERT' together with the inspector's work-mark, the monogram of the establishment at which the item was first certified inert, a two digit representation for the year during which the item was rendered inert, and the item registration number for that calendar year beginning at 001 and running consecutively throughout the year. The marking is to take the following form:

  INERT 323/PWF/04/027

- The marking in the form depicted above becomes the new unique identification details for the inert EO.

- If an item is too small to be marked in accordance with the requirements above, a metal tag is to be engraved with the required markings and the tag should be securely attached to the item.

i. Registration of inerted items, including:

   - the requesting unit.
   - a description of the item.
   - the certifying agency.
   - certification number.
   - the certification date.
   - details of the authorised inspector that completed certification.

j. Document all residual safety hazards (including those that are not explosive hazards) and necessary management strategies for each item of inerted EO to advise units of WHS hazards, risks and necessary management of items. This document is to accompany an inerted item.

k. Retention of records associated with inerting EO.

4.14 Units are required to raise and maintain an Inert Stores Register which will comprise of the original copies of certification documentation for Inert EO and all safety documentation necessary for the safe management of inert EO. The Register must also include:

a. a description and location of the item.

b. at least one photograph of the item; the inspectors qualification, PMKeyS number, rank and name, and

c. the unique marking of the item.

4.15 Units are to implement safety controls to manage the health and safety risks identified for inert EO.

4.16 From the date of issue, all EO is to be rendered and/or inspected and certified inert in accordance with the requirements of this regulation. Historical EO 039 certifications for items may still be considered valid providing items exhibit no signs of discolouration or crystalline growth when visually inspected. Items must be non-technically visually inspected at least annually.

REGULATION 2.5 - EXPLOSIVE ORDNANCE LIFE

Regulation 2.5: (Intent) All Explosive Ordnance (EO) intended for storage and transport within the Australian Defence Organisation must have a defined life consistent with the item's continued safe storage.

General Overview

5.1 Explosive Ordnance (EO), including Non Explosive Dangerous Goods items managed as EO, may degrade with age and exposure to the environment. This degradation may result in the EO becoming unsafe to store, transport and/or operate. The EO may also fail to meet its functional and performance requirements. Accordingly, all EO is assigned a life that is a function of its design and intended use within a defined environment.

Requirements

5.2 All EO stored and transported within the Australian Defence Organisation (ADO) must be assigned a Storage and Transport life. This life is the total period for which an item of EO, under specified conditions, may be expected to remain safe to store and transport. This life must be promulgated before an item enters the ADO Storage and Distribution network.

5.3 Where EO retains functional safety and performance requirements it must be assigned a Service Life. Service Life is the maximum period for which an item of EO, whilst stored and when subsequently used in its operational or training role, may be expected to remain safe and continue to meet the requirements of its Functional and Performance Specification (FPS). Further requirements on the application of Service Life is within DEOP102 Part 2 Chapter 10.

5.4 Lives are to be expressed in time and, if relevant other means such as flying hours and/or number of flights. Further details on lifing definitions are provided at annex A.

Note: further requirements for EO Lifing for items intended for the Defence Inventory is provided at DEOP102 Part 2 Chapter 10. This content is also useful guidance when considering lifing for other EO within the ADO context.

5.5 Assigned lives must be periodically reviewed to ensure safety levels are maintained. The life of EO may be extended or reduced both permanently or temporarily as the case requires.

Note: further detail on EO Surveillance and Life management for items intended for the Defence Inventory is provided at DEOP102 Part 2. This content is also useful guidance when considering lifing for other EO within the ADO context.

5.6 EO must be disposed of before the expiration of the Storage and Transport life.

Responsibilities

5.7 **Operational Acceptance Authorities**. Operational Acceptance Authorities, such as Deputy Chief of Joint Operations (DCJOPS), may grant life extensions for items that may affect operational readiness of Defence Force units in consultation with item Logistic Managers.

5.8 **Logistic Managers**. Logistic Managers of EO are responsible for:

a. Determining EO life to maintain safety, and where appropriate functional performance, through a robust assessment process;

b. Promulgating life data and ensuring that promulgated life data across applications and publications is consistent;

c. Periodic Review of EO life;

d. Approving amendments to EO life;

e. Notifying all changes and variations to life data to Capability Managers, stockholders custodians and users;

f. Ensuring that Operational Acceptance Authorities are made fully aware of the hazards and risks associated with granting life extensions to meet operational readiness objectives; and

g. Ensuring that EO is disposed of before the expiration of Storage and Transport Life.

5.9 Sponsors for Non-Defence Organisations. Where Non-Defence Organisations (e.g. Foreign/Visiting Forces, other Government Department etc.) intend to use the ADO EO Storage and Distribution network for their EO, sponsoring Organisations are responsible for ensuring that the Non-Defence Organisation provide Storage and Transport lifing details to the intended custodians of the stock:

5.10 Individual stockholders, custodians and users. Individual stockholders, custodians and users of EO are responsible for the following:

a. Routine management and use of lifed EO within prescribed limits, including continuous monitoring of the condition of the EO and maintenance if applicable;

b. Segregation of Service Life expired stores, constraining their accessibility, and communicating withdrawal from service to the relevant Logistic Manager;

c. Where desirable, submission of requests for life extensions for items of EO to Logistic Managers; and

d. Management of EO of unknown pedigree or uncertain life with due care to eliminate explosives hazards and minimise risks.

Annexes:

A. Further Details on Lifing

ANNEX A

Further Details on Lifing

Introduction

1. This annex provides further details on Lifing issues that explain management practices and requirements.

Lifing Definitions and Guidance

2. EO life is often considered to be made up of 'Service Life' and Disposal Phases', which form a subset of the 'Storage and Transport Life' of the EO.

3. Lives are normally to be expressed as periods of time, normally in months. However, Operational Lives in particular, may need to be expressed in other ways, for example, in flying hours and/or sorties, or the number of times EO may be installed into, and removed from, parent equipment.

4. The following terms and definitions are applicable to the management of life for EO (and NEDG) and are the only ones authorised for use in Defence

a. **Storage and Transport Life.** The Storage and Transport (S & T) Life is the total period for which an item of EO, under specified conditions, may be expected to remain safe to store and transport. The S & T Life comprises the Service Life and the Disposal Phase (where these are promulgated).

b. **Service Life.** Service Life is the maximum period for which an item of EO, whilst stored and when subsequently used in its operational or training role, may be expected to remain safe and continue to meet the requirements of its Functional and Performance Specification (FPS).

c. **Operational Life.** The Operational Life may be defined as a subset of the Service Life, for which an item of EO, when used in its specified operational or training role, may be expected to remain safe to operate and meet the requirements of the FPS. An Operational Life is assigned where the operational environment is expected to result in an accelerated rate of aging relative to that experienced in the storage environment. If an item reaches the end of its Operational Life without being expended, the Service Life will automatically expire and it will enter the Disposal Phase. Operational Lives cannot generally be aggregated, that is, they are all limiting and when one life expires all other forms of Operational Life expire. Three types of Operational Life may be used:

- **Unpacked Life.** Unpacked Life is the time, within the Service Life, for which an item of EO, which has had its manufacturer's hermetically sealed packaging opened, may be expected to remain safe to operate and will meet the requirements of the FPS. Note that this Life normally only applies to items whose critical failure mode is subject to increased degradation when removed from the parent packaging. The countdown of Unpacked Life cannot normally be halted once the packaging has been opened. Specific circumstances may be exempt from this, such as the opening and inspection of a hermetically sealed item conducted in a controlled atmosphere where the packaging is appropriately resealed.

- **Installed Life.** The Installed Life is the time, within the Service Life, for which an item of EO may be expected to remain safe to operate and will meet the requirements of its FPS while installed or fitted to another assembly. Installed Life is used where the critical failure mode is a function of the installed environment: for example, the exposure to vibration. Hence, Installed Life can be started and stopped, but cannot exceed the Service Life or Unpacked Life. Items that may require an Installed Life include EO fitted to an aircraft, such as ejection seat components, or fire bottle cartridges mounted in armoured vehicles or aircraft.

d. **Disposal Phase.** The Disposal Phase is the time, outside the Service Life, for which an item of EO will remain safe only to store, transport and dispose of. The Disposal Phase is the period following the expiration of the Service Life and by when disposal must be completed. Should the item have an Operational Life, which is initiated (as explained above), the resulting accelerated ageing will bring forward the Disposal Phase.

e. **Life Expired.** EO becomes life expired when the Service Life is exceeded. Once life expired the EO is to be disposed of as soon as practicable within the Storage and Transport Life and in accordance with Defence policy.

5. The following paragraphs are included to clarify and/or qualify the application and implementation of management of life data for EO and are to be read in conjunction with figure 1A-1 (note DEOP102 provides an example with this figure):

a. The ‘S&T Life’ phase for EO includes storage by the manufacturer prior to delivery, transport to major depots, all storage at major depots and EO storage areas and onboard ships and includes the disposal phase. This includes the ‘Service’ and ‘Operational’ Lives where applied

b. EO is assumed to be in the S&T Life phase until a specific event initiates the Operational Life, e.g. Cartridge Actuated Device (CAD) installed into aircraft equipment.

c. Unpacked Life commences from the date the hermetically sealed container is opened. When an Unpacked Life starts the expiry date details are to be marked on each item in the format EXP day/month/year e.g. EXP 15/MAR/01. The Unpacked Life is never to exceed or extend beyond the Service Life.

d. Countdown of Unpacked Life cannot be halted once the Unpacked Life has commenced.

e. The Installed Life starts when either the EO is installed in its intended operational position or, in situations authorised by the Logistic Manager, such as when the platform becomes serviceable after installation of the lifed explosive component(s). For example during an F/A-18 Hornet SMDC Kit change, the Installed Life of egress components begins when the aircraft becomes serviceable. When specified by the Logistic Manager, Installed Life can be temporarily halted when the item is removed for maintenance or similar activities. This is because the failure mode is a function of the installed environment, such as exposure to platform vibration. Clearly, once the EO is removed from that environment, further degradation may not occur. Importantly, this assessment can only be made once there is a clear understanding of the failure mode of each configuration. Installed time intervals are cumulative. The accumulated Installed Life of an item is never to exceed or extend beyond the Service Life.

f. The life of EO is deemed to have commenced at 0001 hrs on the date of manufacture. If the exact day of manufacture is not known, it will start from the first day of the month of manufacture. The life will expire at 2359 hrs of the appropriate day. For example, a store with a 5-year Storage Life and manufactured on 20 May 1994 would life expire at 2359 hrs on 19 May 1999. If the exact day and month of manufacture is not known, the Storage Life would commence at 0001 hrs on 01 Jan 1994 and expire at 2359 hrs on 31 Dec 1998.

g. **Part ‘Operational’ Life Expired EO.** When user establishments decide not to use part ‘operational’ life expired EO, for instance because of short remaining life, such EO is to be treated as life expired.

h. **Variation in Life Due to Differing Roles**. Some natures of EO may be assigned different lives when used in different roles. This can occur when the roles do not require the same level of reliability. When life of stocks is varied under these circumstances the Logistics Manager will promulgate management requirements.

ANNEX A

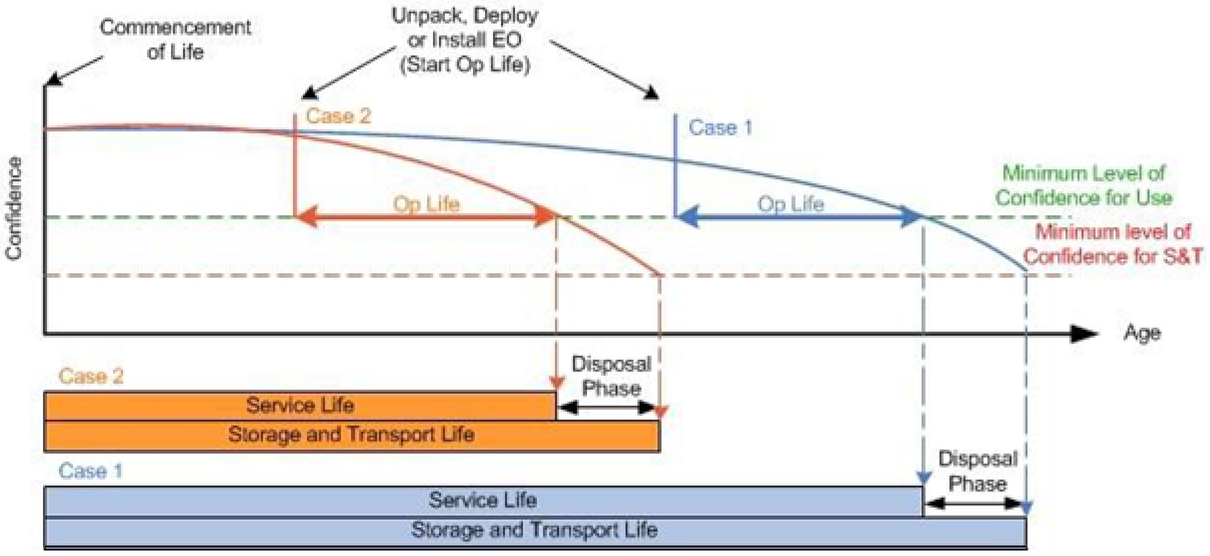


Figure 1A–1: EO Lifing Diagram

REGULATION 3.1 - TRANSPORT OF EXPLOSIVES

General Overview

1.1 The requirements of national legislation, codes of practice and international conventions for the safe transport, by all modes, of dangerous goods in UN Class 1 (Explosives) are incorporated into this regulation.

Requirements

1.2 All Explosive Ordnance (EO), under the control of Defence, must be transported in accordance with the requirements of this regulation.

1.3 **Hazard Classification.** All EO requires Hazard Classification in accordance with the requirements of Regulation 2.1.

1.4 **Security.** All Defence EO consignments are to be transported in accordance with the security requirements of the Defence Security Principles Framework (DSPF). The DSPF is the Competent Authority approved security plan as required by Regulation 27 of the Explosives Transport Regulations (ETR).

1.5 **Emergency Response Plan.** An Emergency Response Plan must be developed for all transport activities. The plan must take into consideration the requirements of Regulation 4.4 Procedure 15 paragraph 15.56.

1.6 **Handling Between Modes.** When EO is to be handled in the process of changing modes from one mode to another, the activity is to be conducted at a licensed site. Refer to Section 4.

1.7 **Reporting and Investigating Accidents and Incidents.** The reporting and investigation requirements for EO related accidents and incidents are detailed in Regulation 1.3. These are in addition to the immediate reporting requirements detailed in the relevant Emergency Procedures Guide (EPG). Defence Road Transport Instructions are also relevant when Commonwealth vehicles are damaged.

1.8 **Air Transport.** EO for air transport by:

a. Civil air is to be in accordance with International Air Transport Association (IATA) Dangerous Goods Regulations, Air Navigation Orders part 33, and International Civil Aviation Organisation (ICAO)-Technical Instructions for the Safe Carriage of Dangerous Goods by Air.

b. Service air is to be in accordance with Australian Air Publication 3631.002 - Dangerous Goods – Transport by Service Air and ICAO.

1.9 **Sea Transport.** Transport of Defence EO:

a. By merchant shipping is to be in accordance with the International Maritime Dangerous Goods (IMDG) Code, Navigation Act 1912, and Australian Standard AS 3846-2005 – The Handling and Transport of Dangerous Cargoes in Port Areas.

b. In Defence ships' magazines is to be in accordance with the Australian Book of Reference (ABR) 862 Volume 2 – RAN Explosive Ordnance Safety Manual Instructions for HMA Ships and Submarines. Where ships magazines do not comply with the requirements of ABR 862 Vol 2, or general cargo areas are used the IMDG Code and AS 3846-2005 are to apply.

c. On inland waterways is to be in accordance with the guidance promulgated in Part VI of AASTP-2 and the requirements of the ETR adapted appropriately, unless otherwise approved by Director General Explosive Ordnance (DGEO).

d. That is containerised through State or Territory dangerous goods wharves, including commercially owned and/or operated wharves, may be conducted in accordance with AS 3846–2005. The separation distances of AS 3846-2005 are not to be applied to warship ammunitioning/de-ammunitioning activities.

1.10 Road and Rail Transport. Transport of Defence EO by road and rail:

a. Is to be in accordance with the AE Code as amended by the ETR. Refer to Regulation 2.1 for classification aspects.

b. Requires that a Competent Authority (CA) be appointed in accordance with the ETR.

c. Is regulated by the States and Territories where the ETR are silent on legislative issues, Defence is to conform to these laws.

d. The ETR and AE Code are not applicable to:

(1) The packaging and marking of EO that has been recovered in an EO Disposal operation conducted by Defence.

(2) The transport of an explosives demolition kit by the ADF for the conduct of EO Demolition/Improvised Explosive Device operations.

(3) The transport of EO during a special activity, and training for that activity, that has been approved by an authorised officer appointed by the Chief of the Defence Force.

(4) The transport of EO that has been detected and seized by a Commonwealth Public Official in circumstances in which it is reasonable to believe that there is a threat to national security or public safety.

(5) The transport on a light vehicle[1] as specified in the ETR, of up to one kilogram (Net Explosive Quantity) of Commonwealth EO, not including detonators, if the explosives are authorised explosives within the meaning of the AE Code. The following appointments for their respective commands are authorised to enact this application of the ETR:

(a) Commander SOCOM.

(b) DGEO.

(c) Chief, Weapons and Countermeasures Division, DSTO.

(6) A person who is involved in the transport of EO in a place:

(a) That is occupied or controlled by the ADF.

(b) That is declared under Regulation 49 of the Defence Force Regulations 1952 to be a Defence Practice Area.

(c) Where Commonwealth explosives are manufactured or tested.

(7) Transport of EO for a training exercise, to and from a place that is occupied or controlled by part of the ADF and a nearby place where that particular training

[1] Light vehicle means a vehicle that has a gross vehicle mass, within the meaning of the Road Transport Reform (Heavy Vehicles Registration) Act 1997, not greater than 4.5 tonnes.

exercise is being, or is to be, carried out by that part of the ADF, on a vehicle forming part of the equipment of that part of the ADF. This is only to apply to:

(a) The exercise movement of EO between two gazetted training areas (excluding barracks areas) if the EO:

(i) Represents a combat load in a combat vehicle; and

(ii) Is stowed in the approved equipment or attachments of the vehicle in an approved manner.

or

(iii) Is carried on the individual member in the approved manner in the vehicle.

and

(iv) The distance does not exceed 25 km.

(b) Exemption (7) (a) does not apply to vehicles carrying category 2 or category 3 EO as specified in table 1-1 below.

e. Transport of packaged EO, in approved and correctly marked containers, of the type and quantity per vehicle not exceeding Risk Category 1 as defined in Table 1-1. The requirements of AE Code, Chapter 4 are not applicable to the transport of EO determined as Risk Category 1 so long as the EO is being transported in a passenger vehicle.

Type of Explosives [2]	Quantity per Vehicle [1]		
Division	**Category 1 (Low Risk)**	**Category 2 (Moderate Risk)**	**Category 3 (High Risk)**
Division 1.1A [3]	Transport must be specifically approved by the Competent Authority		
Detonators of 1.1B	≤125 items	>125-5000 items	>5000 items
All other **Division 1.1**	≤5 kg	>5-250 kg	>250 kg
Division 1.2	≤5 kg	>5-250 kg	>250 kg
Division 1.3	≤50 kg	>50-1000 kg	>1000 kg
Detonators of 1.4B or 1.4S	≤125 items	>125 items	n/a [5]
All other **Division 1.4**	≤250 kg	>250 kg	n/a [5]
All other **Division 1.4S** (other than Detonators)	Any quantity	n/a [5]	n/a [5]
Division 1.5	≤25 kg	>25-250 kg [4]	>250 kg [4]
Division 1.6	≤25 kg	>25 kg	n/a [5]

Table 1-1 – Risk Categories for Explosives

Notes:

(1). Quantity in NEQ, except where otherwise specified.

(2). For mixed loads, the Division and Capability Group for the entire load shall be determined as outlined in Section 7.3.2 (of the AE Code), prior to assigning the appropriate Risk Category to that load.

(3). Transport of explosives of Classification Code 1.1A is to be specifically approved by the Competent Authority.

(4). This applies only for the purposes of Section 8.4 (of the AE Code), quantities of explosives of Division 1.5 greater than 250 kg are considered to be Category 3.

(5). “n/a” – means not applicable.

(6). For transport of Class 5.1 with Class 1 refer to Sections 2.4(3) and 2.4(4) (of the AE Code) to determine the risk category.

1.11 Exemptions from the ETR. A person may apply in writing to the CA for an exemption from compliance with a provision of the ETR. An exemption must be staffed through the relevant single service safety authority for approval by the CA with an information copy to DOS-JLC.

1.12 Postal System. EO must not be consigned through the postal system.

1.13 **Safety Certification.** When the safe condition of EO is suspect, certification that the EO is safe for further handling, transportation and storage must be undertaken. Safety certification is required for:

a. EO which has malfunctioned or misfired, except for small arms ammunition.

b. Defective EO, where the defect is considered to affect the continued safety of the item.

c. Damaged EO, where the damage may affect the continued safety of the item.

d. Suspect EO, e.g. items that have been dropped.

Responsibilities

1.14 Each element of Defence involved in the transport of EO, including civilian transport agencies, is to ensure compliance with this regulation and the associated procedures.

Procedures

1.15 Procedures to implement the requirements of this regulation are:

a. Procedure 1 - Transport of Explosive Ordnance; and

b. Procedure 2 - Certificate of Safety.

PROCEDURE 1 - TRANSPORT OF EXPLOSIVE ORDNANCE

Introduction

1.1 Since 1981, when the Department of Defence adopted the UN System for the Classification of Dangerous Goods, published in the United Nations (UN) Publication ST/SG/AC.10/1 - Recommendations on the Transport of Dangerous Goods – Model Regulations (UN System), a periodic review has been undertaken of national regulatory standards and international agreements relating to the transport of dangerous goods, and in particular, explosive ordnance (EO). This procedure aligns Defence policy and procedures for the safe transport of EO, by all modes, with the latest national legislation and codes of practice, departmental policies and international conventions. To ensure the safe transport of EO, strict adherence to these procedures is necessary.

Purpose

1.2 This procedure provides additional detail for the requirements of Regulation 3.1 - Transport of Explosives.

Applicability

1.3 This procedure applies to the transport of EO in the public domain and within Defence establishments.

POLICY APPLICATION AND IMPLEMENTATION

Competent Authorities

1.4 The Minister for Defence has ownership of the Explosives Act 1961, and the responsibility for regulatory and administrative aspects pertaining to the transport, classification, marking and packaging of Commonwealth EO as defined in the Act, including all Defence EO. Within Defence, Director General Explosive Ordnance (DGEO) has the responsibility of administering and regulating these transport procedures and has been appointed, vide the requirements of Regulation 10 of *Explosives Transport Regulations 2002 Statutory Rules No. 92, 2002* (ETR), as the Competent Authority (CA)[1] for all road and rail transport activities involving Commonwealth EO[2].

1.5 Each State and Territory has a CA with statutory duties under State and Territory legislation for the land transport of explosives. The Australian Maritime Safety Authority (AMSA) and the Civil Aviation Safety Authority (CASA) have CA responsibilities in relation to the transport of explosives by sea and air, respectively.

1.6 Individual Defence Groups are to exercise the authority for organic transport of EO within/between Defence establishments by Defence ships (except on inland waterways) and Defence aircraft. Navy and Air Force Group Managers are to exercise the authority for non-organic transportation of EO by Defence ships and aircraft respectively. The Directorate of Ordnance Safety (DOS), through the appropriate departmental channels, is responsible for advising on the application and interpretation of this policy.

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[1] The appointment of a Competent Authority (CA) is vested in a position filled by either a commissioned officer of the Defence Force being of at least the rank of Commodore, Brigadier or Air Commodore, or an SES employee of the Department of Defence, not an individual. If the appointment is dissolved then this authority is divested and ministerial approval of a new appointment is necessary. DGEO is the CA for transport of Dangerous Goods UN Class 1 (explosives) matters, and this authority extends outside the Department of Defence.

[2] Commonwealth EO includes EO that is the property of, or in the possession or control of the Department of Defence and EO belonging to foreign defence forces that are in Australia or its territories with the approval of the Commonwealth Government – see Explosives Act 1961.

Subordinate Instructions

1.7 Defence is bound by transport procedures specified in Commonwealth law, and the Department complies with international conventions relating to the transport of dangerous goods. Each element of Defence involved in the transport of EO is to ensure that EO transport operating procedures comply with this procedure, and that separate local implementing instructions are prepared when it is considered necessary to amplify this procedure and/or detail local responsibilities.

Visiting Forces

1.8 Visiting forces are subject to the relevant Status of Forces Agreement (SOFA). If a visiting force is to move its own EO with its own vehicles within Australia or its Territories, movement is to be in accordance with the relevant Commonwealth and State law. Where the EO is to be moved by the Australian Defence Forces (ADF), or by Defence contracted civilian agency on behalf of the visiting forces, the EO is to be packaged, marked and transported in accordance with this procedure. In such circumstances, the host Service/unit is responsible for ensuring compliance – see also paragraph 1.14. Where visiting forces are acting or training independently and no individual Defence unit has responsibility for logistic or safety aspects, DGEO as the CA, will appoint a Defence unit, with appropriately qualified technical liaison officers, to provide technical and logistic liaison to promote compliance with this procedure, consistent with the terms of the SOFA.

Licensing

1.9 When EO is to be handled in the process of changing from one mode of transport to another, the activity is to be conducted at a site appropriately licensed for the storage and/or handling of EO, see Regulation 4.4 Procedure 14. Guidance on the requirements for licensing by the Licensing Authority is given in Regulation 5.2.

Regulatory essential processes for EO in transit

1.10 In addition to the requirements for transport detailed within these regulations there may be a requirement to conduct supporting activities as part of the transport activity. These activities are considered essential to comply with regulations and must be completed prior to or as part of the transport activity and must be managed and approved under the respective transport mode regulations. Intermediate transportation activities that are considered regulatory essential include:

a. Other State and Commonwealth Government Department checks and inspections.

b. Securing, covering and checking of loads.

c. Completion of mandatory administrative processes relevant to mode of transport.

d. Compulsory driver rest and refreshment breaks.

e. Vehicle checks, emergency repairs and refuelling activities.

1.11 Any other EO storage or handling activity that occurs in the process of transporting EO, but is not considered regulatory essential in accordance with the above direction, must be licensed, see paragraph 1.9 and Regulation 5.2.

Commercial Support Activities

1.12 Where the land transport of EO is to be out-sourced under the commercial arrangements, the contract must contain a clause that requires EO Services Providers to conduct the activities in accordance with the requirements of the ETR and Australian Code for the Transport of Explosives by Road and Rail (AE Code), and this procedure. Contractors are required to seek a Deviation where activities are planned to be undertaken in support of Defence, where DEOP 101 requirements cannot be met. Defence contractors cannot directly apply for a Deviation but must submit applications through their contracting authority. Procedures for seeking deviations are prescribed at regulation 1.2. EO Services Providers are to carry their own risk in conducting the activities for which they have contracted, and are to apply appropriate safety mitigation strategies to minimise risk. EO Services Providers, Departmental or other government road movement agencies are to be aware that where the ETR and the AE Code are silent, relevant State and Territory laws for the transport of dangerous goods apply.

1.13 Compliance with the requirements at paragraph 1.12 may be resource intensive and therefore tenderers for Defence contracts must be informed of this. It is highlighted that the provisions outlined in this procedure apply only to EO for which Defence has legally accepted 'ownership' or control vide the Explosives Act 1961. Defence requires compliance with the following during transportation:

a. Commonwealth Legislation on EO.

b. The requirements for attendants, escorts and escort vehicles in accordance with the Defence Security Principles Framework (DSPF) when EO is transported.

c. The accounting for and checking of EO in accordance with the ESCM.

d. The reporting of loss, theft, compromise or any security incident involving the EO in accordance with the DSPF.

e. The maintenance of EO in a serviceable condition (EO load restraint and protection from the elements).

f. The reporting of any incident or accident during the transport activity in accordance with Regulation 1.3.

1.14 Prior to contracts being awarded to companies to undertake any functions relating to the transport of EO for Defence or visiting forces, the contracting Defence area or host must ensure that the company has the appropriate facilities and procedures in place to adequately meet the provisions of the ETR, AE Code and DSPF, and this manual. Tenders involving EO must include appropriate evaluation criteria.

CONSIGNMENT PREPARATION PROCEDURES

EO Classification and Classification Listing

1.15 The ETR requires the classification of EO to be in accordance with the UN System. All Defence EO classified in accordance with the UN System is listed in Explosive Storage and Transport Committee (ESTC) Pamphlet No 2 - Defence Explosive Ordnance Classification Listing (DEOCL) (available from the Directorate of Ordnance Safety (DOS) intranet site). If EO is received which is not listed in the DEOCL direction is to be sought from the ESTC.

1.16 If EO is received which is packed in other than the package approved in the DEOCL, it is to be repacked into its approved package or reported to the EO Management Agency for approval and classification of the alternative package and inclusion in DEOCL prior to being submitted for transport.

Emergency response plans

1.17 Each element of Defence involved in the transport of EO is to develop, promulgate and exercise Emergency Response Plans to deal with any accident involving their EO. The ESTC PAM 7 – A guide to the Transport of Defence Explosives by Road may be referred to for guidance.

Transport Requests and Documentation

1.18 Consignors/shippers are to ensure that EO consignments are classified, packaged, marked, labelled, documented and certified appropriate to the proposed mode of transport.

1.19 **Movement Categories.** The movement of EO is grouped into two categories:

a. Category One – covers the movement of EO by unit/supply facility/establishment's organic transport, or by other transport moving under command of the organisation responsible for moving the consignment.

b. Category Two – covers the movement of EO by other than unit organic transport. It involves a transport agency moving a consignment as a result of a movement or requisition order.

NOTES

1. Movements of EO by an EO Services Provider are Category two movements.

2. Administrative arrangements for the movement categories are contained in the DSPF Principle 79, Control 79.1 Annex B.

1.20 Land Transport Consignments. All EO to be consigned by non-organic (Category 2) land transport (road and rail) is to be declared and documented in accordance with transport agency requirements e.g. Form ST 116 – Movement/Requisition Order - Freight. Where consignments are in support of operations and exercises, all requests are to be submitted in sufficient detail and time as required by the Defence Logistics Manual Part 2 Volume 8 – Logistics Support to Operations and Exercises (DEFLOGMAN PT2 Vol 8), to allow proper assessment of the consignment's suitability for acceptance into the transport system.

Note:

Form ST 116 is not required when EO Services Provider or its sub-contractor transport EO to or from requesting units.

1.21 Air and Sea Consignments. All EO to be consigned by air or sea is to be declared and documented in accordance with the requirements of the agencies listed in paragraphs 1.38 and 1.53 respectively.

1.22 Documentation. In addition to the appropriate accounting documentation, all Category one and two movements of EO in the public domain, except as detailed in the AE Code, Section 4.2, and paragraphs 1.59 and 1.62 of this procedure, are to be accompanied by the appropriate Shipper's Declaration of the following:

a. Form ST 160 – Shipper's Declaration for Dangerous Goods (for air transport modes).

b. Form AMSA 250 - Multimodal Dangerous Goods Form[3] (for surface transport[4] or civil/commercial shipping) - Australian Maritime Safety Authority, Marine Orders Part 41 - Dangerous Cargoes refers[5].

or

c. Form AB 788 – Shipper's Declaration for Dangerous Goods for Surface Mode.

The purpose for the Shipper's Declaration, and guidance on the preparation and use of Forms ST 160, AB 788 and AMSA 250 is given at Annex A and Part 1 Section 8, Chapter 1 to Australian Air Publication, AAP 3631.002 – Dangerous Goods – Transport by Service Air (for Form ST 160).

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[3] Form MO 41/A is obtainable from the Australian Maritime Safety Authority through its website at http://www.amsa.gov.au/Forms/AMSA250.pdf

[4] As an alternative to the use of a separate shipper's declaration form, for surface transport modes only, the consignor's/shipper's standard dangerous goods transport documents may incorporate the information and certification requirements recommended in United Nations (UN) Publication ST/SG/AC.10.1 - Recommendations on the Transport of Dangerous Goods – Model Regulations for shipper's declarations.

[5] More information is available from AMSA

Authorisation of Personnel to Certify Shipper’s Declarations

1.23 Only personnel who are assessed as competent (See Regulation 1.1 Procedure 1) to certify Shipper's Declarations may be authorised to do so. By virtue of qualifications gained through specific training in the requirements for completing shipper’s declarations, the following Defence personnel (including contractors to Defence), are authorised to certify Form AB 788 or AMSA 250 (for certification of Form ST 160 see Annex C to Part 1 Section 8, Chapter 1 to AAP 3631.002 – Dangerous Goods – Transport by Service Air for Dangerous Goods Class 1):

a. Ammunition Technical Officer.

b. Ammunition Technician.

c. Service personnel who have completed the RAAF Engineering Officer Armament Specialist Course.

d. Personnel who are DGPACKACCEPTAIR or DGPACKACCEPTALL qualified (restricted to the certification of EO packages that have station monogram seals intact).

e. Personnel who have completed the Explosive Custodian Officers Ashore Course.

f. Personnel who have completed Explosive Ordnance Supervisor or Explosive Ordnance Manager training.

g. Supply personnel (Explosives qualified).

h. Personnel who hold the following national competencies:

(1) TLIA3015A – Complete received/dispatch documentation.

(2) TLID3015A – Identify and label explosives and dangerous goods.

(3) TLIF1207D – Apply safe procedures when handling/transporting dangerous goods or explosives.

(4) DEFEO503C – Conduct explosive ordnance packaging inspection.

(5) DEFEO204C – Examine and certify free from explosive ordnance.

(6) DEFEO301D – Package ammunition.

(7) DEFEO501D – Conduct explosive ordnance inspection.

Packing, Marking and Sealing of Explosive Ordnance

1.24 All EO is to be packed in its approved packaging (see paragraph 1.15) and packages are to be marked and sealed in accordance with Regulation 2.3.

Transport of Empty Explosive Ordnance Packages

1.25 The requirements for the preparation and transport of empty EO packages are detailed in Regulation 2.3 Procedure 5.

Security

1.26 All consignments of EO transported under the control of Defence personnel or EO Services Providers are to be accorded the highest level of protective security in accordance with the requirements of the DSPF.

1.27 **Certificates of safety.** Certificates of safety are to be issued as required by paragraph 1.13 of Regulation 3.1.

IMPORTING/EXPORTING EXPLOSIVE ORDNANCE

Importation of Explosive Ordnance – Safety Certification

1.28 The Project Office, Explosive Materiel Branch (EMB) within the Capability, Acquisition and Sustainment Group (CASG) or other Sponsoring Agency in Australia that is responsible for importing EO, is to ensure that:

a. The EO is packaged and classified in accordance with the UN System.

b. The EO has been certified by the appropriate CA of the exporting nation with respect to its compliance with the UN System classification, packaging procedures, and international dangerous goods transportation conventions, International Air Transport Association (IATA) Dangerous Goods Regulations, International Maritime Dangerous Goods Code (IMDG Code) and International Civil Aviation Organisation (ICAO) - Technical Instructions for the Safe Carriage of Dangerous Goods by Air.

c. The Form GI-039 – Application for a Defence Explosive Ordnance Classification Listing (available via the Defence Web Forms System) is completed and forwarded to the Explosives Storage and Transport (EST). For new items of EO, either introduced into Service or for test and evaluation purposes, Form GI-039 is to be submitted before importation is permitted.

1.29 Appropriately certified importation forms are to reach the EST section at least 30 days prior to the EO reaching an Australian point of entry to enable sufficient time for the data to be checked and local safety authorities to be advised of the cargo's arrival. Failure to submit the form in time could result in the cargo being embargoed by Customs or confiscated by local dangerous goods regulatory enforcement agencies. An International Importation Certificate (IIC) may also be required by the exporting nation. This may be obtained from the Defence Export Controls (DEC) web site. Additionally, some exporting nations also require an End User Certificate (EUC) to be provided by the importer before an export licence is granted.

1.30 **End user certificates**. In an endeavour to control the international movement of EO, many western governments, including Australia, do not permit the export of EO unless the recipient government issues an EUC certifying that the EO will not be passed to a third party without the approval of the government of the original supplying country. Much of the EO currently in ADF use is subject to EUC control by the original supplying nation. Consequently, this EO may not be exported to a third party country without the consent of the originally supplying nation. Advice on EUC requirements may be obtained from DEC. Only DEC, Counsellor Defence Materiel (CONDMAT) London and Washington are delegated by the Minister to sign EUC on the Commonwealth's behalf.

Export of Explosive Ordnance from Australia for Defence Exercises

1.31 At times it may be necessary for Defence to conduct training exercises in foreign countries using its own EO. Exercise planners are to obtain approval from the host country to import such EO during the exercise planning stage and well before force deployment. The lead-time for such approval may be considerable, e.g. the USA requires 90 days notice. Failure to obtain approval could result in EO being embargoed. Only EO to be used under the strict control of Defence personnel and required to meet the exercise needs is to be exported. Surplus EO arising from the exercise is to be returned to Australia unless advised to the contrary by the CA.

Export of Explosive Ordnance from Australia for Defence Operations

1.32 Export of EO from Australia in support of operations requires special International arrangements to be in place. Some or all of the following will apply:

a. United Nations Resolution.

b. United Nations Mandate.

c. Status of Forces Agreement.

d. Diplomatic Note.

e. Participation Agreement.

f. End User Agreements.

g. Destination Storage Requirements.

h. Diplomatic Clearances.

1.33 All of the above will be subject to Government direction and agreement and have to be taken into account early in the planning phases for operations overseas.

Customs and Quarantine Services Clearance

1.34 All documentation for Customs and Quarantine related clearances required by the Australian Customs and Border Protection Service and the Department of Agriculture is to be raised and submitted by the shipping agent before the EO reaches an Australian point of entry or exit. Project, EMB, Directorate Explosive Ordnance Governance (DEOG) within the Explosive Ordnance Branch (EOB) or sponsoring staff are to provide technical support if required to raise the appropriate documentation. Where EO is imported or exported by Service air, refer to Australian Air Publication 3631.002 – Dangerous Goods – Transport by Service Air.

Defence Exercises in Australia

1.35 Planners of Defence exercises in Australia that require the movement, storage and use of EO will need to involve the following organisations:

a. Australian Defence Force Warfare Centre for land clearance.

b. DEOLC Explosive Ordnance Licensing Authority (EOLA) for temporary storage requirements and licensing for Minor exercises.

c. Headquarters Joint Operations Command (HQJOC) for temporary storage requirements and licensing for Major exercises as defined at Regulation 5.2 Procedure 1.

d. 1st Joint Movement Unit (1JMU) for movement coordination and approval for movement through civil airfields.

Recovery to Australia of Munitions Captured or Acquired on Operational Service.

1.36 The recovery of munitions, ie weapons and EO, captured or acquired on operational service, and their subsequent movement from the theatre of operations to Australia, may involve a level of hazard and risk to personnel and property. Defence policy for the safe recovery and preparation for consignment to Australia of such munitions is detailed in DEFLOGMAN Part 2 Volume 8 Chapter 8 – Appropriation and import of Defence related material during Australian Defence Force operations.

OPERATIONS AND EXERCISES

1.37 1JMU is responsible for providing Movement Control and Movement Coordination for all operational and exercise freight, including EO, in accordance with the appropriate operation or exercise tasking directive. 1JMU is also responsible for the 'Load to Mode' selection for all freight, including EO, moving in support of an operation or exercise. Units deploying/redeploying on an operation or exercise will be required to submit their load requirements, including EO, by Deployment Planning Data Sheet (DPDS) to 1JMU. When an operation or exercise reaches its 'sustainment phase' units will be required to submit their load requirements, including EO, by Movement Request

(MOVREQ) to 1JMU. 1JMU has no involvement or responsibility in the movement of EO by EO Services Providers within Australia.

SPECIFIC INSTRUCTIONS FOR AIR TRANSPORT

General

1.38 1JMU is responsible for processing all bids for the movement of EO by Service Air either domestically or internationally. Domestic and International civil air movement of EO meeting the standards of the IATA may be booked directly with the civil mode operator by the individual Service. International movement of EO requiring the charter of civil assets is to be referred to 1JMU.

1.39 The single Services retain responsibility for transport of EO fitted as an integral part of weapons systems on their specialist transport modes in accordance with their respective EO Orders and Instructions. Should a single Service require assistance in support of their specialist transport mode they should, in the case of air movement, contact 1JMU and in the case of surface movement contact DEOG Tech Services.

State Aircraft

1.40 Military aircraft travelling overseas will always be 'state aircraft' and require diplomatic clearances arranged by the Department of Defence. Civil aircraft under charter to the Department of Defence may be specified as 'state aircraft' and then must be treated similarly. Civil chartered aircraft not classed as 'state aircraft' are subject to normal ICAO requirements.

Diplomatic Clearance Requirements

1.41 Diplomatic clearances are required each time an aircraft of state (Military or Department of Defence charters) fly through the air space of or land in a foreign country. Diplomatic clearances typically take two weeks to process with some countries taking up to six weeks. No diplomatic clearance means no transit or landing approval. Diplomatic clearances must be obtained before an aircraft attempts to enter foreign air space. The movement of EO through or over foreign countries is a particularly sensitive subject with refusals not uncommon. Accurate and timely EO information with maximum prior notice is therefore required.

1.42 Staff Officers responsible for planning for the movement of EO to or from overseas (Operations, Exercises, Projects or purchase) on Military or Defence chartered aircraft should contact Staff Officer Diplomatic Clearances at Headquarters Air Command early in the planning process.

1.43 Information required for each diplomatic clearance submission is shown at Annex B.

Air Transport of Explosive Ordnance through Civilian Airfields

1.44 The process to be followed to obtain approval for the carriage of explosive goods into or through civilian airfields is set out at Annex C. Civil Aviation Advisory Circular AC 139-12 (0) Handling of Hazardous Materials on an Aerodrome, provides advisory information on Safety Distances and procedures for explosives laden aircraft at civilian airfields. Copies are available on the CASA web site.

Civil Air Transport of Explosive Ordnance

1.45 Civil air transport of EO is to be in accordance with IATA, Air Navigation Orders Part 33, and ICAO. Consignors are advised that Australian air carriers will only accept EO listed as acceptable for air movement in the current year edition of the IATA. All such consignments are to be correctly prepared, documented and consigned in accordance with IATA subject to delay in movement due to the small number of dedicated cargo aircraft available.

Dangerous Goods Forbidden for Carriage by Civil Air

1.46 IATA and ICAO permit on a case by case basis in exceptional circumstances the carriage of EO normally forbidden for transport by civil air. This authority is vested in the CASA. Where such EO has to be moved to meet an operational necessity and that movement cannot be carried out by Service Air then, HQ1JMOVGP is to submit an appropriate request to the CASA (Dangerous Goods Compliance Branch) for consideration. This process may take upwards of one week.

Service Air Transport

1.47 The carriage of EO by Service Air is to be in accordance with Australian Air Publication 3631.002 – Dangerous Goods – Transport by Service Air and the IATA. Leased aircraft registered on the State register and crewed solely by Service personnel may, with the concurrence of the lessor, be operated in accordance with the procedures outlined in Australian Air Publication 3631.002 – Dangerous Goods – Transport by Service Air. Leased aircraft registered on the civil register and crewed by Service personnel using their civilian licence may, with the approval of CASA and the concurrence of the lessor, be operated in accordance with the procedures outlined in Australian Air Publication 3631.002 – Dangerous Goods – Transport by Service Air, otherwise they must comply with the requirements of IATA and Civil Aviation Act 1988.

1.48 **Civil versus Military Requirements for Packaging Explosive Ordnance.** Movement problems can occur because of different packaging requirements for EO between the Service requirements at DEOCL and Australian Air Publication 3631.002 – Dangerous Goods – Transport by Service Air and the civil packaging in accordance with the IATA. Where combined Service and civil movement of EO is necessary, personnel need to be cognisant of this potential problem and take it into account when packaging/preparing the EO.

Airport Notification

1.49 Airport management organisations, both civil and military, are to be warned in advance by the aircraft operator of EO transiting their facilities. For military aircraft (Navy, Army, Air Force) the Wing/Squadron/Unit is responsible for advising details of EO being carried. For chartered aircraft the aircraft operator is responsible.

1.50 When EO is to be loaded or unloaded, be that within Australia or overseas, in addition to the notification by the aircraft operator (see paragraph 1.44), the following organisations are responsible for ensuring the appropriate notifications are made:

a. Movement in support of operations or operations provider – 1JMU Services Provider.

b. Projects/purchase – JLC/EO Management Agency.

Other issues

1.51 1JMU is responsible for the:

a. Operational air movement of EO that cannot be moved by civil air due to the constraints of the IATA.

b. Air movement by Service or civil air over long distances, of EO normally moved by other modes over short distances eg the serviceability of some guided weapons may be unduly degraded by road or rail vibrations if transported over long distances.

Guidance for Processes

1.52 Flowcharts outlining the broad processes for the movement of EO by Air in support of Operations and Exercises, Project Support and Administrative Support are attached for guidance at Annexes D, E and F respectively.

SPECIFIC INSTRUCTIONS FOR SEA TRANSPORT

General

1.53 Navy, through the Commander Australian Fleet (COMAUSFLT) coordinates requests for the carriage of EO by Service maritime transport. Civil sea movement of EO in support of operations or exercises is to be arranged by 1JMU in accordance with paragraphs 1.37. Other civil sea movement is to be arranged directly by the organisation requiring the move.

Service Shipping/HMA Warships

1.54 The carriage of EO in ships' magazines is to be in accordance with Australian Book of Reference (ABR) 862 Volume 2 - Maritime Explosive Ordnance Safety Manual. Where ships' magazines do not comply with the requirements of Australian Book of Reference 862 Volume 2 - Maritime Explosive Ordnance Safety Manual (ABR 862 Volume 2), or general cargo areas are used, the requirements of the IMDG Code and AS 3846 – 2005 are to apply.

Transport on Inland Waterways

1.55 Unless otherwise approved by CJLOG, or elsewhere in this procedure, the transport of EO on inland waterways is to be in accordance with the guidance in Part VI of AASTP-2 and the requirements of ETR appropriately adapted for the purpose.

Port Procedures

1.56 Operations from Defence maritime facilities are to be in accordance with Part V of AASTP-2. The movement of containerised EO through State or Territory Dangerous Goods wharves (including commercially owned and/or operated wharves) may be conducted in accordance with AS 3846 – 2005. The separation distances of AS 3846 – 2005 are not to be applied to warship ammunitioning/de-ammunitioning activities.

Guidance for Processes

1.57 Flowcharts outlining the broad processes for the movement of EO by Sea in support of Operations and Exercises, Project Support and Administrative Support are attached for guidance at Annexes G, H and I respectively.

SPECIFIC INSTRUCTIONS FOR ROAD AND RAIL TRANSPORT

Applicability of the Explosives Transport Regulations and Australian Explosives Code

1.58 The ETR makes provision for exemptions from both the Regulations and the AE Code for certain activities. The AE Code also exempts certain requirements, see paragraph 1.10 d of Regulation 3.1.

Competent Authority exemptions from the Explosive Transport Regulations

1.59 Occasionally, circumstances may warrant the performance of activities that are inconsistent with the policy and regulations outlined in this procedure. As a consequence, people and property may be exposed to risk greater than that inherent in the transport principles herein defined. In such circumstances, the CA for the purposes of the ETR, Regulation 16, may issue an exemption of a temporary nature provided the exemption is consistent with the provisions of the ETR. For single Service EO transport activities all applications for an exemption that would permit non-compliant activities must be staffed through the relevant single Service safety authority, normally the Deputy Chief of the Service concerned, for approval by the CA. Where possible, essential non-compliant activities are to be approved before being undertaken.

1.60 In the event that an existing and essential activity is considered by any authorised auditing authority to be non-compliant, and the non-compliant activity cannot be immediately remedied, then the detail must be reported as a matter of priority to the CA, who may authorise the continuation of the activity for a specific period. The submission is to be in writing and must address the requirements of Regulation 15 (2) of the ETR. If continuation is not approved, the activity must cease immediately.

1.61 Should a requirement be identified which is inconsistent with the provisions of the ETR, the CA, in consultation with the Director Ordnance Safety, may decide to approach the Minister for Defence with a request for the issue of an appropriate Ministerial Order pursuant to the provision under Regulation 14 of the ETR.

Applicability of State and Territory law

1.62 The Explosives Act 1961 binds all Commonwealth Departments to Commonwealth, State and Territory laws/regulations for the transportation of EO. Where conflict is identified between extant Commonwealth, State and Territory laws/regulations, details of the conflict are to be raised for resolution through appropriate channels. The Commonwealth laws/regulations are to take precedence until the conflict is resolved. Where ETR are silent on safety issues covered by State or Territory laws, the Department of Defence is to conform to those laws.

Transport requirements

1.63 The transport of EO by road and rail is to be in accordance with the ETR and the AE Code. Penalties for contravention of the ETR are set out in Section 20 of the Explosives Act 1961. Authorities consigning EO by road or rail are to be particularly cognisant of the following:

a. **Appointment of supervisors.** The appointment of a supervisor for the handling[6] of EO by an 'authorised person' was a requirement of the now repealed Regulations, but is not a requirement of the ETR. Nonetheless, the AE Code requires the supervisory function to be performed by the consignor. This may involve one person supervising all aspects of EO handling, or alternatively different personnel to supervise different aspects of EO handling, e.g. one person to supervise the loading, unloading, stacking and storing while another person supervises the transport of the EO. Supervisors for all aspects of handling are now to be appointed and authorised in writing by the person's Officer-in-Charge or Commanding Officer. Such appointments and authorisations are to be recorded in a local register. Registers are to be retained for a minimum of two years.

b. **Responsibilities.** ESTC Pamphlet Number 7 - 'A Guide to the Transport of Defence Explosives by Road' has been produced by the ESTC to direct the attention of staff to those requirements in the ETR, AE Code and DSPF which are their responsibility and to assist them in their observance. This publication will not replace the source references. All supervisors and drivers are to be issued with a copy and carry it either on their person, or in the vehicle, during their involvement in EO transport operations.

c. **Petrol, diesel and LPG fuelled vehicles.** Certain conditions apply to the use of petrol, diesel and LPG fuelled vehicles in EO areas and facilities. These are detailed in Regulation 4.6 Procedure 2.

d. **Truck loading procedures.** Where truck loading procedures are available they are to be followed when loading EO onto a road vehicle. Similarly, procedures for the loading of ISO containers with EO should be prepared and implemented as required.

e. **Truck holding areas.** Vehicles and ISO containers whether or not loaded onto a vehicle, that are loaded with EO and delayed during dispatch/unloading, are to be parked in an area licensed as a truck holding area.

f. **Emergency Procedure Guides.** An Emergency Procedure Guides (EPG) provides details of the load being carried, the hazards associated with the load and procedures to be followed in case of an accident, fire or spill. Prior to commencing a journey with an EO load the driver of a road vehicle, or the master of a towing craft, is to be provided with an EPG applicable to the load being transported. At the completion of the journey the EPG is to be removed from the vehicle or craft. EPGs that are not applicable to the load are NOT to be carried on a vehicle or craft. The EPG are to be placed in the EPG holder during transport so they are readily identifiable and available if an emergency arises. An example of an EPG is contained in the AE Code. Defence approved EPG forms are listed as follows:

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[6] Handling' includes loading, unloading, discharging, stacking, stowing, storing, transporting and any operation incidental to, or arising out of, any of those operations in relation to explosive ordnance.

(1) **AE 306 -** Emergency Procedure Guide for HD 1.1, 1.2, 1.3, 1.5 and 1.6.

(2) **AE 307** - Emergency Procedure Guide for HD 1.4.

g. **Marking of road and rail vehicles.** All road and rail vehicles transporting EO are to be marked as detailed in the AE Code, Chapter 3.

h. **Explosives routes.** The AE Code requires EO loaded vehicles to travel by the safest practicable route and to make inspection stops during the trip. Prior to the departure of EO loaded vehicles, explosives routes and inspection stops are to be determined by the appropriate supervisor, documented and provided to the driver.

i. **Audio players.** Factory fitted and fused audio players powered by the vehicle battery may be operated in the driver's cabin of a vehicle transporting EO. Portable audio players may be operated in the driver's cabin of a vehicle transporting EO provided they are:

(1) Powered by their own batteries and remain in the driver's cabin.

(2) Not mounted as permanent fixtures to the vehicle and are effectively insulated from the vehicle body.

(3) Not opened to exchange batteries.

(4) Removed from the vehicle prior to entering an EO area and deposited at the entrance gate.

(5) Not operated in a vehicle that does not have a separate driver's cabin (e.g. a van).

j. **Mobile RF emitters and mobile telephones.** Certain conditions apply to the use of mobile RF emitters and mobile telephones in vehicles transporting EO. These are detailed in Regulation 4.4 Procedure 15.

k. **Licensing.** Drivers of vehicles carrying EO are required to hold a vehicle license for the particular vehicle that they are driving and must be qualified and current in the 'Transport Dangerous Goods and Commonwealth Explosives by Road' competency. Licensing requirements are as follows:

(1) **Australian Defence Force personnel.** As advised in Chapter 3 of the Defence Road Transport Manual (DRTM), section 123 of the Defence Act 1903, exempts members of the Defence force from requiring to hold a State or Territory civilian drivers' licence for the operation of Defence vehicles. Members of the Defence force are also exempt from any age or experience requirements specified in State or Territory legislation for the driving of Defence vehicles. Procedures for gaining a Defence licence are promulgated in the DRTM.

(2) **Defence APS personnel including contractors.** Defence APS personnel and contractors must meet the requirements of their State or Territory based dangerous goods licensing system.

POSTAL SYSTEM

1.64 EO, including dummy, inert and drill natures and components, is not to be consigned through the postal system. Under Part 10.5 of the Criminal Code Act 1995, it is an offence to cause explosives to be carried by post is prohibited, and subject to a penalty of imprisonment.

Annexes:

A. Preparation and Use of Forms ST160, MO 41/A and AB 788
B. Diplomatic Clearance Information for Overseas Movement of Explosive Ordnance by Air

ANNEX A

PREPARATION AND USE OF FORMS ST160, AMSA 250 AND AB 788

1. When EO is submitted for transport it is to be accompanied by one of the following Shipper's Declarations depending on the mode of transport:

a. Form ST 160 - Shipper's Declaration for Dangerous Goods (for air mode), or

b. Form AMSA 250 - Multimodal Dangerous Goods Form, or

c. Form AB 788 - Shipper's Declaration for Dangerous Goods – Surface Mode.

Forms ST 160 and AB 788 are available via the Defence Web Forms System. Form AMSA 250 is available via the AMSA website.

2. The purpose of the Shipper's Declarations is to provide a certificate by the consignor/shipper, when the consignment is presented to the operator for shipment, that the EO consignment is fully and accurately described and that it is classified, packed, marked and labelled, and in all respects in proper condition for transport in accordance with all applicable regulations and instructions.

3. When EO is being prepared for transport the person responsible for signing the Form ST 160 or AMSA 250 or AB 788, may accept serviceable items without further examination provided:

a. They are correctly packed in accordance with Explosives Storage and Transport Committee (ESTC) Pamphlet No 2 – Defence Explosive Ordnance Classification Listing (DEOCL) and the Topic - 025 of the item publication.

b. They are correctly marked and sealed in accordance with Regulation 2.3 Procedure 2.

c. The packages are not damaged.

4. EO which is other than serviceable is to be fully examined by the person responsible for signing the Form ST 160 or AMSA 250 or AB 788, in conjunction with the preparation of a Certificate of Safety (see Regulation 3.1 Procedure 2).

5. Care is to be taken in the preparation of Forms ST 160, AMSA 250 and AB 788 to ensure that all necessary information has been provided, and that the information is accurate, as incorrectly completed forms may result in the shipment being rejected by the transport authority.

6. The normal distribution for Forms ST 160, AMSA 250 and AB 788 is as follows:

a. Two copies despatched with the documentation accompanying the consignment, and

b. One copy retained by the originator.

ANNEX B

DIPLOMATIC CLEARANCE INFORMATION FOR OVERSEAS MOVEMENT OF EXPLOSIVE ORDNANCE BY AIR

Introduction

1. Information required for each Diplomatic Clearance request submitted by the Department of Defence for Military and Defence charted aircraft is shown at paragraph 2. The Diplomatic Clearance request will be submitted by Staff Officer Diplomatic Clearances Headquarters Air Command however, the success or otherwise of a request could hinge on the accuracy of EO information supplied. It is therefore imperative that EO information required to complete paragraph 2k is accurate and submitted as per the acceptable samples shown.

Information for Diplomatic Clearances

2. The following information is required for each Diplomatic Clearance request:

a. Countries for which clearance is sought.

b. Type of aircraft.

c. Aircraft Registration Number.

d. Callsign.

e. Captain (by Rank, Name and Passport Number).

f. Crew (by Rank, Name and Passport Number).

g. Passengers (by Rank, Name and Passport Number).

h. Purpose.

i. Itinerary (All times Zulu).

j. Route.

k. Cargo and Weapons:

l. Details of any dangerous cargo by:

(1) Item Name (Proper Shipping Name);

(2) UN Number (UN No);

(3) Hazard Classification Code (HCC); and

(4) Net Explosives Quantity (NEQ).

m. Details of any weapons by type and quantity. (Where such cargo and weapons are only carried for part of a task specify which sectors of the journey).

ANNEX C

APPROVAL PROCESS FOR THE CARRIAGE OF EXPLOSIVE ORDNANCE INTO CIVILIAN AIRFIELDS

Introduction

1. This Annex identifies responsibilities and minimum procedures for the safe movement of explosive ordnance (EO) through civilian airfields.

Airport Operator Approval

2. 1st Joint Movement Unit (1JMU) is to seek Department of Infrastructure, Regional Development and Cities/Airport Operator approval prior to consigning EO cargo into or through civilian airfields by either service or civilian chartered aircraft. Approval is to be sought at least five working days in advance for domestic Australian movements and at least ten working days in advance for overseas flights. In seeking approval 1JMU is to advise the Operations Manager of the applicable airfields (including diversion airfields) of the following details by unclassified fax:

a. Date and time of expected movement.

b. Category of movement (international/domestic).

c. UN Number.

d. Proper Shipping Name.

e. Hazard Classification Code (HCC)

f. Net Explosives Quantity (NEQ).

g. Flight Number.

h. Total Weight and Quantity.

i. Number of vehicles involved (if required).

j. HQ1JMOVGP point of contact.

k. Any other relevant special handling information.

CASA/ICAO Compliance

3. Civilian air (chartered, leased or commercial flight) must meet the requirements of the Civil Aviation Act 1988, International Civil Aviation Organisation (ICAO) – Technical Instructions for the Safe Carriage of Dangerous Goods by Air and International Air Transport Association (IATA) Dangerous Goods Regulations, as appropriate, as well as having a Dangerous Goods Manual as part of their approved operational documentation to carry EO in or through Australian airspace. Approval to carry EO through overseas airspace is subject to the requirements of the country(s) owning the airspace and the requirements of the ICAO – Technical Instructions for the Safe Carriage of Dangerous Goods by Air and IATA Dangerous Goods Regulations. All such approvals must follow the full Diplomatic Clearance process.

Safety Distances

4. Safety distances for explosives laden aircraft at Australian airfields are set out in the ICAO – Technical Instructions for the Safe Carriage of Dangerous Goods by Air that is available on the CASA web site www.casa.gov.au.

Aircraft Parking Position

5. The approved parking position will be advised by Airport Operations staff. Marshalling of the aircraft will be arranged by the Airport Safety Officer. If an alternate parking position is required this will be arranged by the Airport Safety Officer.

Handling Agent Vehicle Access

6. Handling agent vehicles will be escorted from air side to a marshalling area by the Airport Safety Officer. All vehicles will be held in the marshalling area until the aircraft is ready to be loaded/unloaded. Airport Operations Safety staff will escort any Defence equipment and vehicles to and from the aircraft. The vehicle(s) carrying the EO onto or off airfields must pre-plan their movements to minimise the amount of time the EO will be located at the airport.

Security Requirements

7. Normal ‘Restricted Area’ security measures will apply to all staff involved in the transfer operation. These security requirements include:

a. only vehicles involved in the transfer allowed air side,

b. only staff required for the transfer are permitted air side; and

c. all visitors are to be issued with and display valid Aviation Security Identification Cards (ASIC) or be issued with and display a Security Restricted Area Visitors Pass issued by Airport Security staff prior to accessing air side. Twenty four (24) hours prior notice is preferable when applying for Visitors passes.

Safety Precautions

8. The following ‘Safety Procedures’ are to be adhered to during the loading and unloading of EO to or from aircraft:

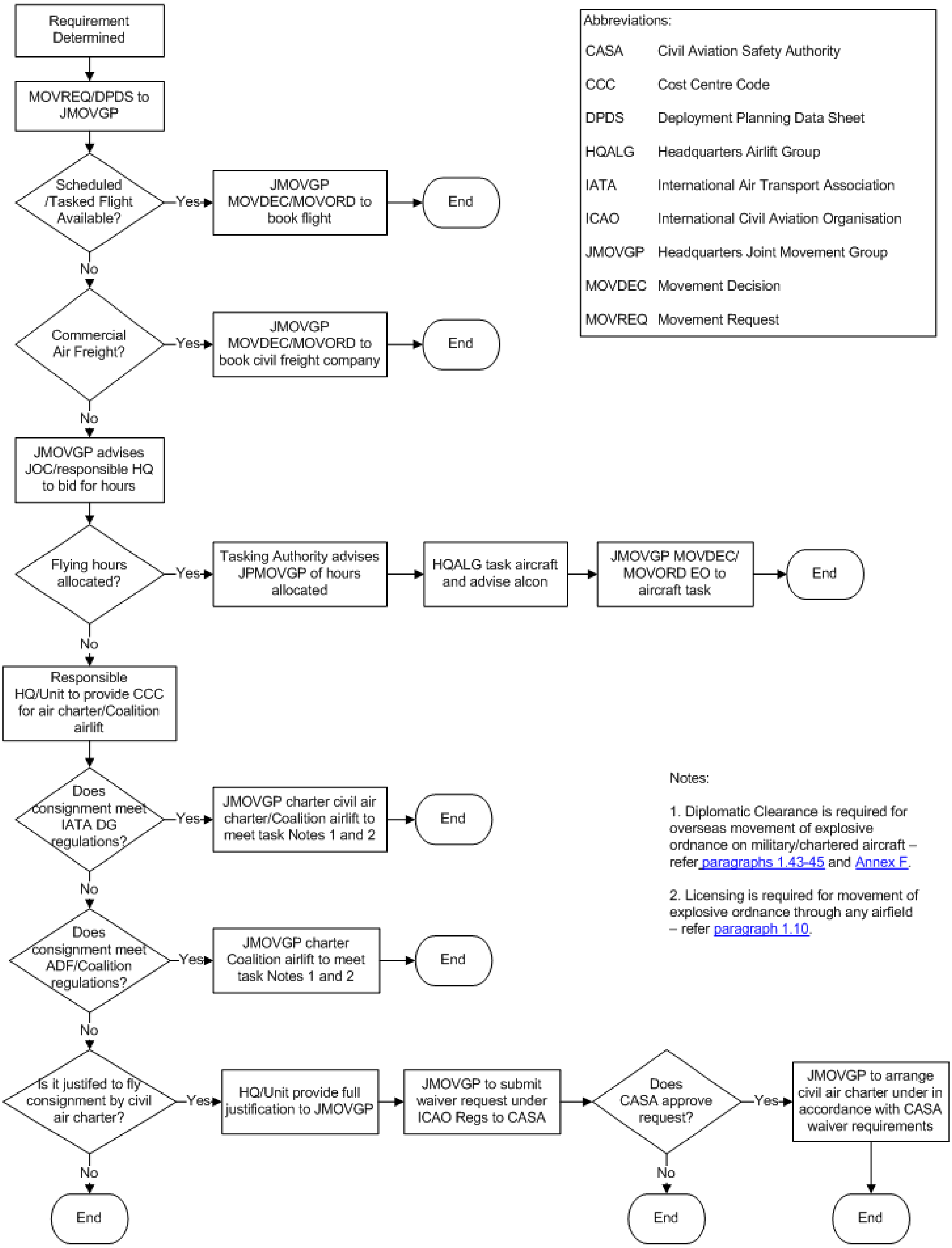
a. loading and unloading may only be commenced with the approval of the Duty Airport Safety Officer,

b. loading and unloading must be in accordance with recognised ICAO/IATA standards, and

c. entry to the designated loading/unloading area prior to or after the transhipping activity must only be undertaken with the permission of the Airport Safety Officer.

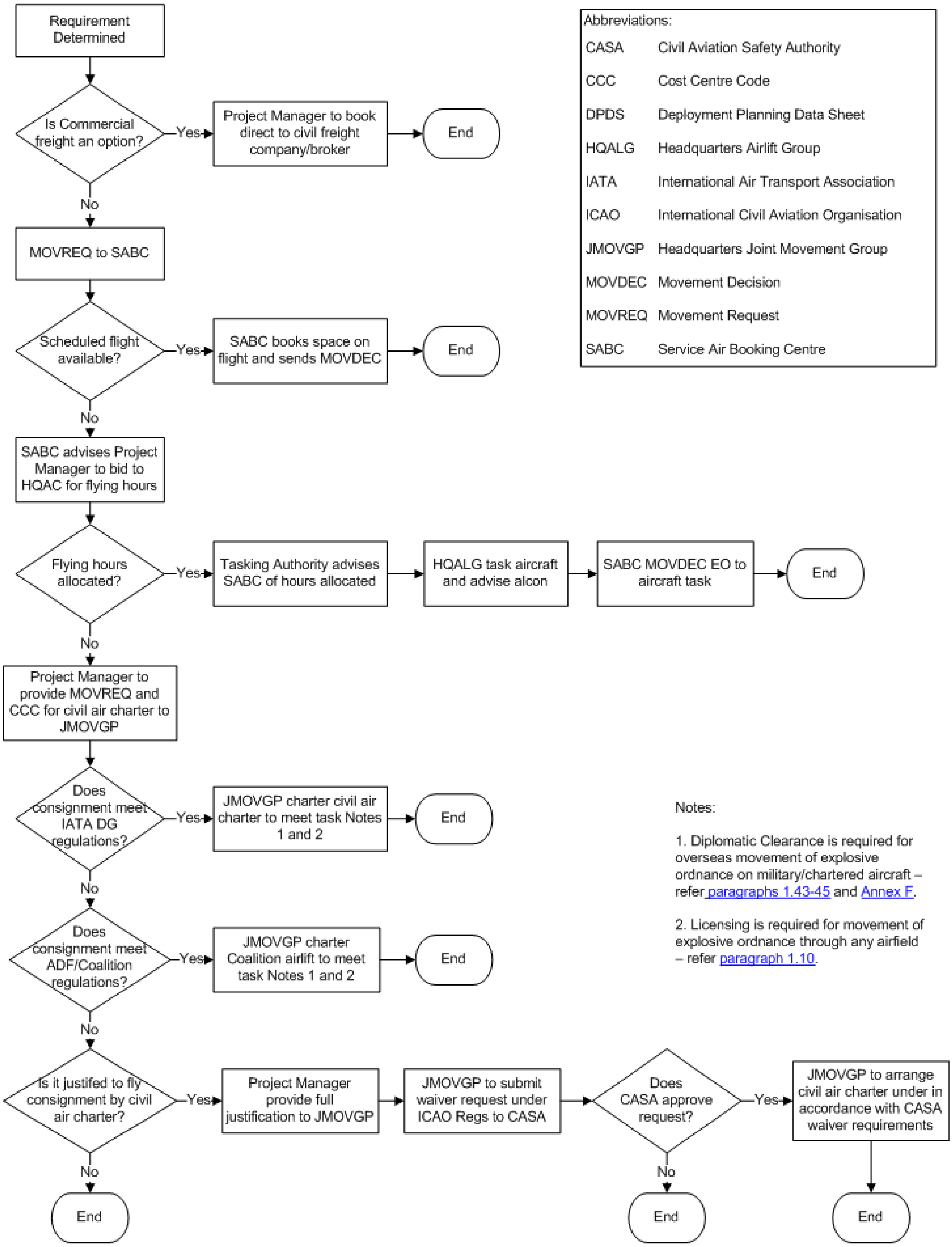
ANNEX D

MOVEMENT OF EXPLOSIVE ORDNANCE BY AIR - OPERATIONS AND EXERCISES



ANNEX E

MOVEMENT OF EXPLOSIVES BY AIR - PROJECT SUPPORT



Abbreviations:

CASA	Civil Aviation Safety Authority
CCC	Cost Centre Code
DPDS	Deployment Planning Data Sheet
HQALG	Headquarters Airlift Group
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
JMOVGP	Headquarters Joint Movement Group
MOVDEC	Movement Decision
MOVREQ	Movement Request
SABC	Service Air Booking Centre

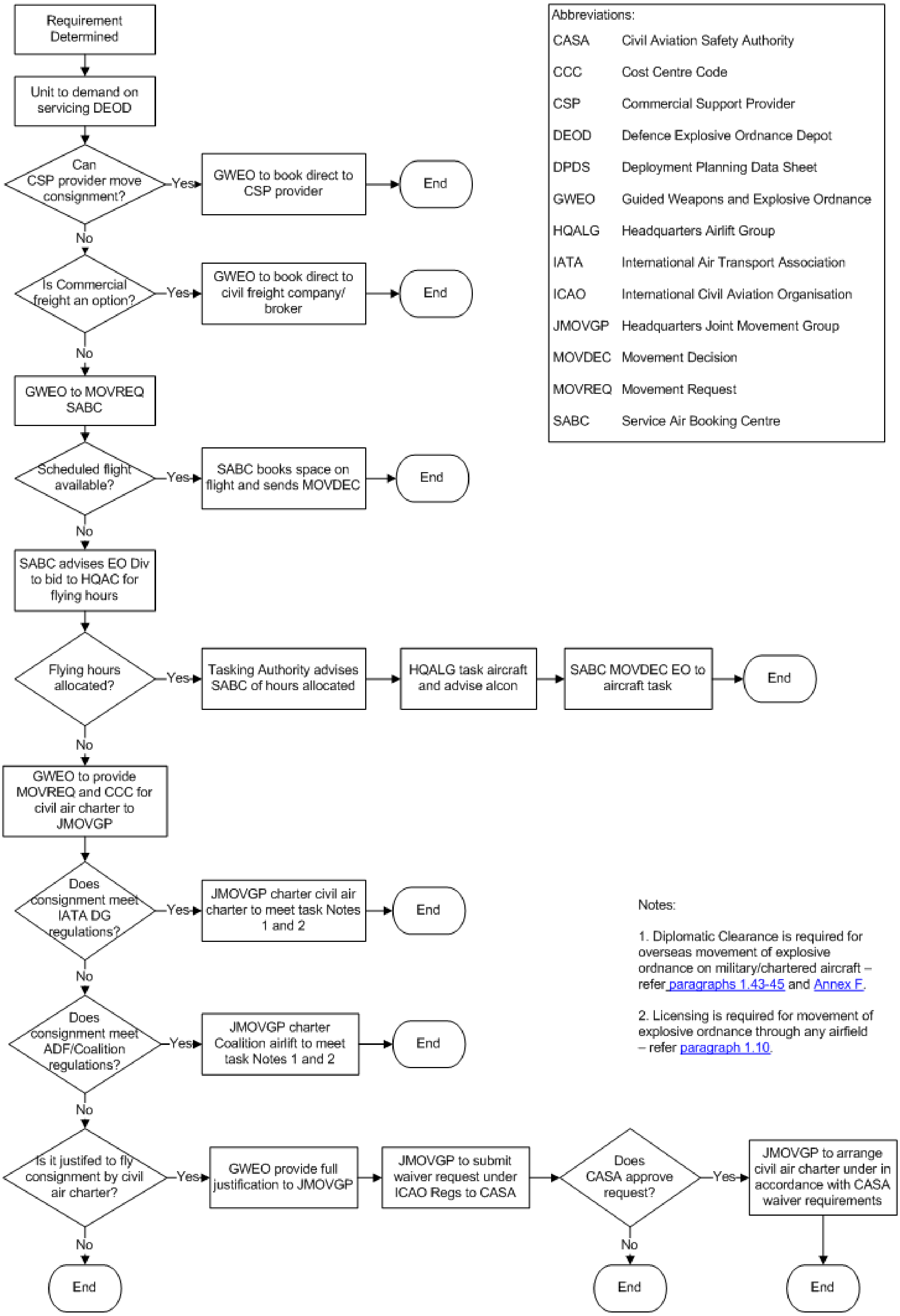
Notes:

1. Diplomatic Clearance is required for overseas movement of explosive ordnance on military/chartered aircraft – refer paragraphs 1.43-45 and Annex F.

2. Licensing is required for movement of explosive ordnance through any airfield – refer paragraph 1.10.

ANNEX F

MOVEMENT OF EXPLOSIVE ORDNANCE BY AIR - ADMINISTRATIVE SUPPORT



Abbreviations:

CASA	Civil Aviation Safety Authority
CCC	Cost Centre Code
CSP	Commercial Support Provider
DEOD	Defence Explosive Ordnance Depot
DPDS	Deployment Planning Data Sheet
GWEO	Guided Weapons and Explosive Ordnance
HQALG	Headquarters Airlift Group
IATA	International Air Transport Association
ICAO	International Civil Aviation Organisation
JMOVGP	Headquarters Joint Movement Group
MOVDEC	Movement Decision
MOVREQ	Movement Request
SABC	Service Air Booking Centre

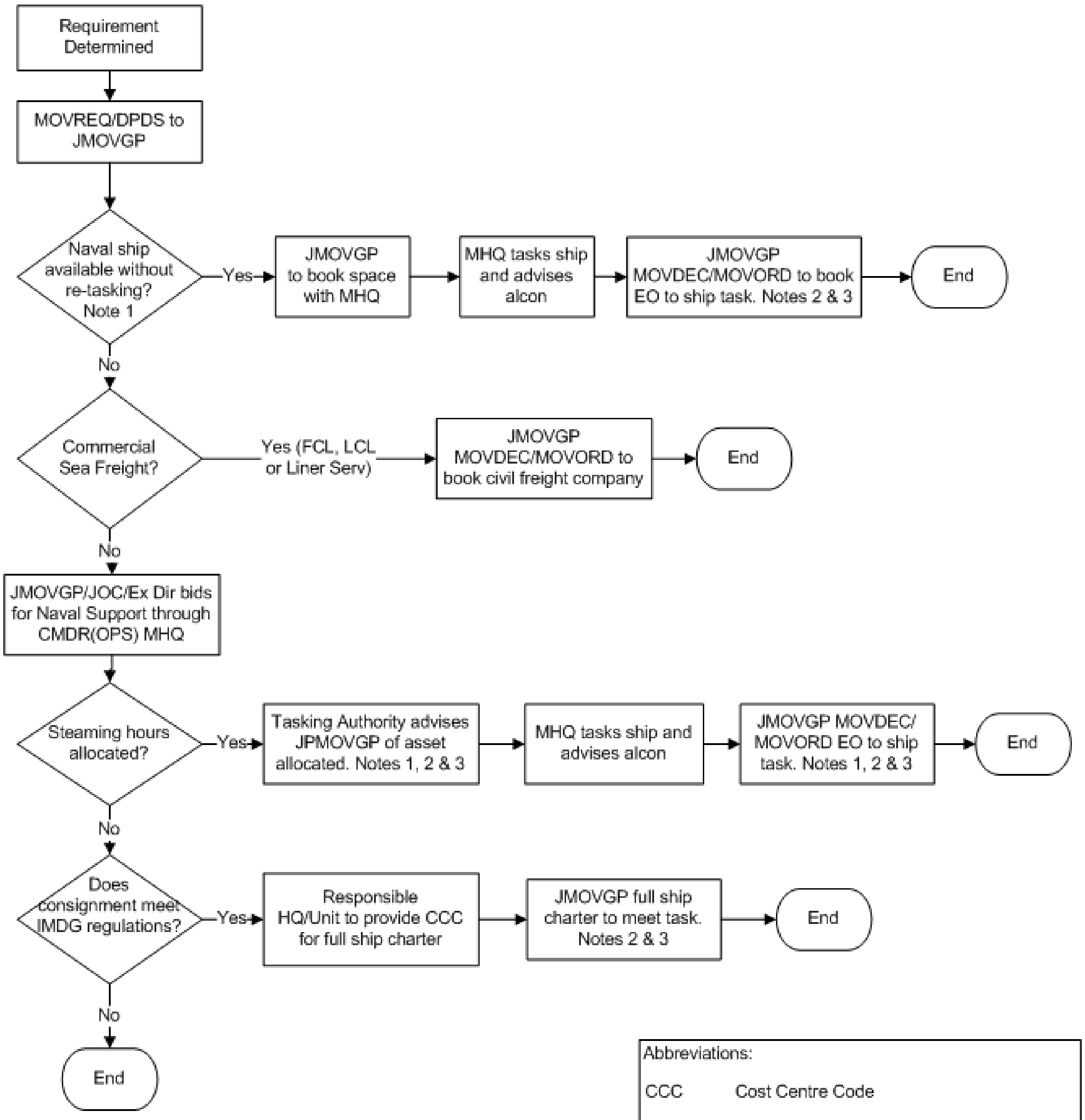
Notes:

1. Diplomatic Clearance is required for overseas movement of explosive ordnance on military/chartered aircraft – refer paragraphs 1.43-45 and Annex F.

2. Licensing is required for movement of explosive ordnance through any airfield – refer paragraph 1.10.

ANNEX G

MOVEMENT OF EXPLOSIVE ORDNANCE BY SEA - OPERATIONS AND EXERCISES



Notes:

1. Carriage to be in accordance with ABR 862 Vol 2

2. Diplomatic Clearance is required for overseas movement of explosive ordnance on military/chartered ships.

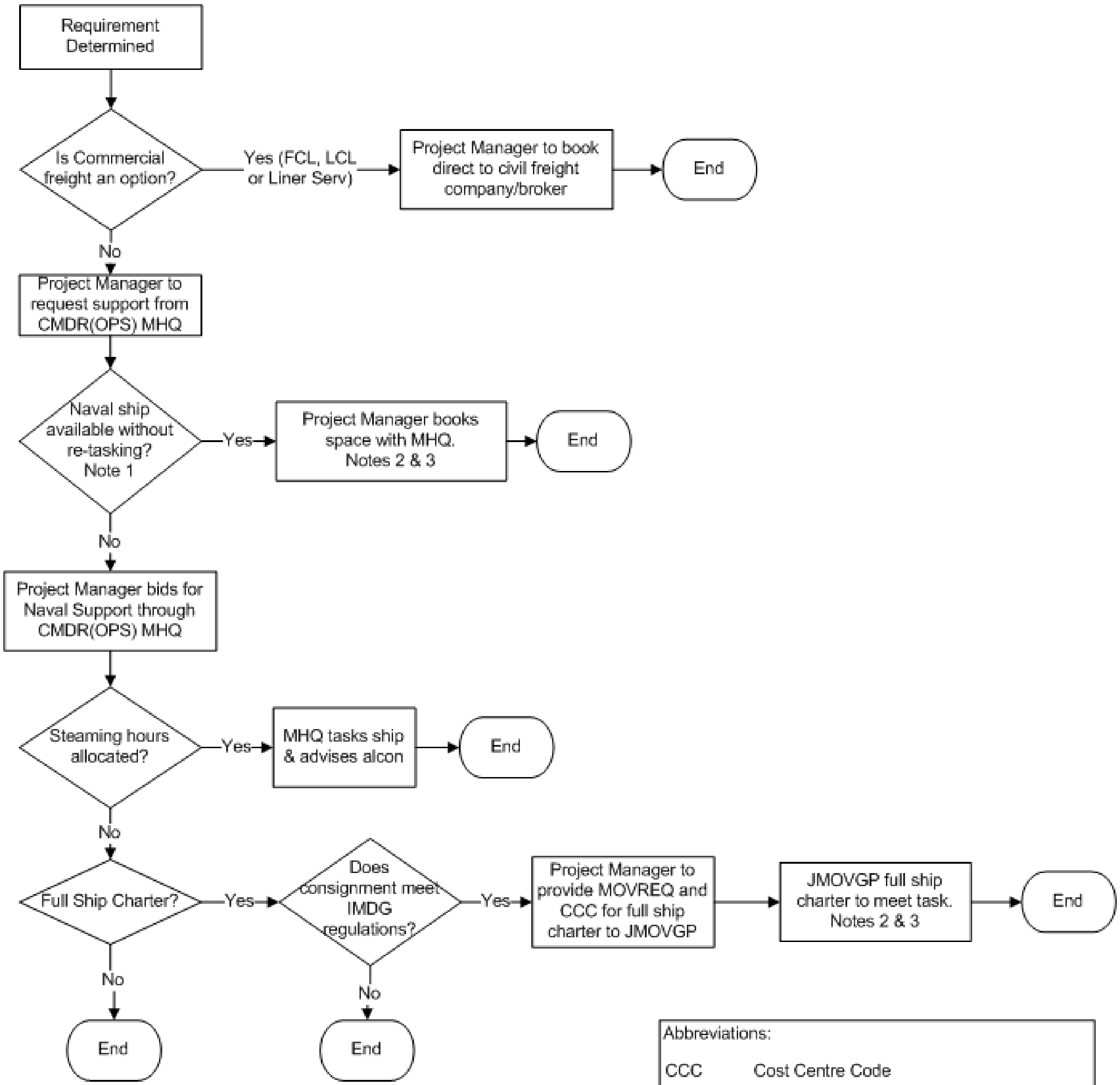
2. Licensing is required for movement of explosive ordnance through any port – refer paragraph 1.10.

Abbreviations:

CCC	Cost Centre Code
DPDS	Deployment Planning Data Sheet
FCL	Full Container Load
IMDG	International Maritime Dangerous Goods
JMOVGP	Headquarters Joint Movement Group
JOC	Joint Operations Command
LCL	Less than Container Load
LPA	Landing Platform Amphibious
MOVDEC	Movement Decision
MOVREQ	Movement Request

ANNEX H

MOVEMENT OF EXPLOSIVE ORDNANCE BY SEA - PROJECT SUPPORT



Notes:

1. Carriage to be in accordance with ABR 862 Vol 2

2. Diplomatic Clearance is required for overseas movement of explosive ordnance on military/chartered ships.

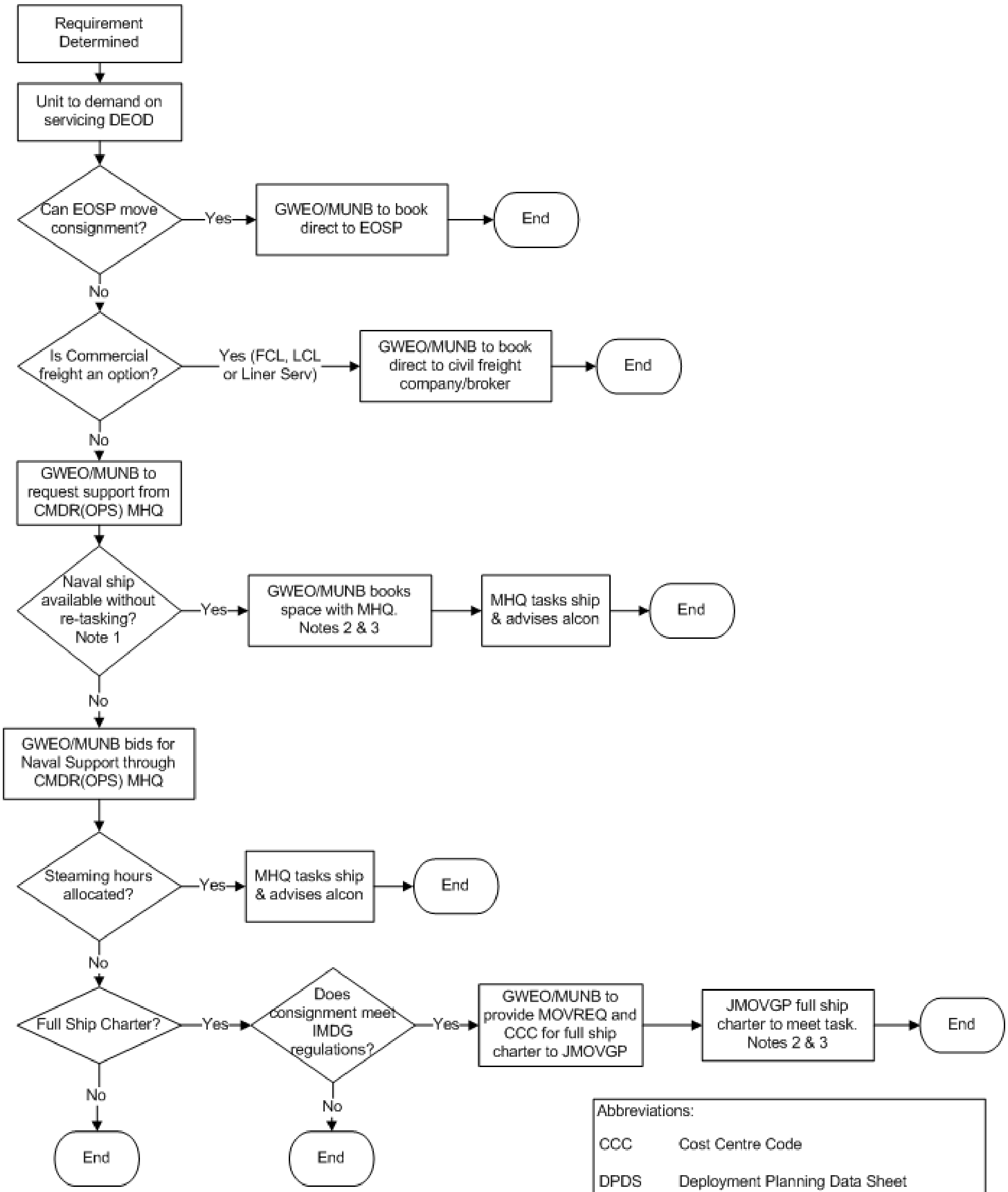
2. Licensing is required for movement of explosive ordnance through any port – refer paragraph 1.10.

Abbreviations:

CCC	Cost Centre Code
DPDS	Deployment Planning Data Sheet
FCL	Full Container Load
IMDG	International Maritime Dangerous Goods
JMOVGP	Headquarters Joint Movement Group
JOC	Joint Operations Command
LCL	Less than Container Load
LPA	Landing Platform Amphibious
MOVDEC	Movement Decision
MOVREQ	Movement Request

ANNEX I

MOVEMENT OF EXPLOSIVE ORDNANCE BY SEA - ADMINISTRATIVE SUPPORT



Abbreviations:

CCC	Cost Centre Code
DPDS	Deployment Planning Data Sheet
EOSP	Explosive Ordnance Supply Provider
FCL	Full Container Load
IMDG	International Maritime Dangerous Goods
JMOVGP	Headquarters Joint Movement Group
JOC	Joint Operations Command
LCL	Less than Container Load
LPA	Landing Platform Amphibious
MOVDEC	Movement Decision
MOVREQ	Movement Request

Notes:

1. Carriage to be in accordance with ABR 862 Vol 2

2. Diplomatic Clearance is required for overseas movement of explosive ordnance on military/chartered ships.

2. Licensing is required for movement of explosive ordnance through any port – refer paragraph 1.10.

PROCEDURE 2 - CERTIFICATE OF SAFETY

Purpose

2.1 This procedure provides for scope, direction and details for raising certificates of safety to enable defective explosive ordnance to be stored and transported when it is required to be issued and who may provide such certification.

Certificate of Safety

2.2 When the safe condition of ExplosiveOordnance (EO) is suspect, a Form SG 131 Certificate of Safety for Handling, Transport and Storage of Defective Explosive Ordnance (short title – Certificate of Safety), is to be raised to certify that the EO is safe for further handling, transportation and storage. Form SG 131 - Certificate of Safety for Handling, Transport and Storage of Defective Explosive Ordnance is available via the Defence Web Forms and detailed completion instructions are given in Annex A, Instructions for Completion of Form SG 131 – Certificate of Safety for Handling, Transport and Storage of Defective Explosive Ordnance.

Issue of Certificate of Safety

2.3 When the safe condition of EO is suspect, certification that the EO is safe for further handling, transportation and storage must be undertaken. Safety certification is required for:

a. EO which has malfunctioned or misfired, except for small arms ammunition;

b. Defective EO, where the defect is considered to affect the continued safety of the item;

c. Damaged EO, where the damage may affect the continued safety of the item; and

d. Suspect EO, e.g. items that have been dropped.

2.4 A Certificate of Safety is not required for EO that is repairable, subject to reclassification, life expired but still within its Storage and Transport Life, or Defence Science and Technology Group (DSTG) controlled items managed within the DSTG Life Management Policy.

2.5 A Certificate of Safety is not to be used should the Storage and Transport Life assigned to an item expires. Under these circumstances, a robust engineering assessment from the Sustainment Manager's engineering network must be conducted prior to handling the item.

2.6 For the purposes of this procedure, malfunctioned or misfired EO is not to be mistaken for Unexploded Explosive Ordnance (UXO). These procedures do not apply to UXO which normally is not to be handled. UXO is to be dealt with in accordance with approved disposal procedures.

Authorisation of Personnel to Issue Certificates of Safety.

2.7 **Authorisation Standards.** Only personnel who are assessed as competent (See Regulation 1.1 Procedure 1) and have gained the necessary level of experience to issue Certificates of Safety may be authorised to do so. Personnel must be authorised by the Officer-in-Charge, Commanding Officer, Commanding Charge or DSTG LA delegate to issue Certificates of Safety. The authorisation is to be promulgated in a register, such as Routine Orders.

2.8 By virtue of qualifications gained through specific training, the following class of person is authorised to issue Certificates of Safety:

a. Navy:

(1) Armament Engineers (WE-ARM and WE-ARM ENG), Explosive Ordnance Engineers (EOE) and Clearance Divers who have successfully completed:

(a) An Armament Engineering Course - DEOTS (DEOH);

(b) A Masters of Science (Explosive Ordnance Engineering);

(c) A Diploma Explosives Engineering (NOEC); or

(d) A recognised equivalent qualification.

(2) Officers or Senior Sailors who have successfully completed the Senior Explosive Ordnance Managers Course.

b. Army:

(1) Ammunition Technical Officer.

(2) Ammunition Technician.

c. Air Force Service personnel who have completed the:

(1) RAAF Engineering Officer Armament Specialist Course.

(2) Senior Explosive Ordnance Managers Course.

d. Australian Public Service (APS) personnel who are employed in a Joint Logistics Unit Explosive Ordnance Services (JLU EOS) Office and have completed the following:

(1) National competencies as listed in paragraph 2.7, either gained through one of the single Service requirements as identified in sub-paragraphs 2.6 a, b or c, or another equivalent recognised training course;

(2) Explosive Inspection Course; and

(3) A minimum six months experience in the position.

e. DSTG members who have completed the Senior Explosive Ordnance Managers (SEOM) Course (PMKeys 112963) or can demonstrate equivalent qualifications may be authorised as DSTG Inspector of Explosives – Issue of Certificate of Safety, by Chief Weapons and Combat Systems Division (CDS EO representative), to certify EO safe for transport.

2.9 For a member to hold equivalent qualification to enable them to be authorised to sign the Certificate of Safety, the member must hold the following national competencies, with a minimum of 6 months experience in an identified position of responsibility:

a. TLID1507D – Identify and label explosives and dangerous goods;

b. DEFEO503C – Conduct explosive ordnance packaging inspection;

c. DEFEO204C – Examine and certify free from explosives;

d. DEFEO301D - Package ammunition;

e. DEFEO501D - Conduct explosive ordnance inspection; and

f. DEFEO205C – Conduct technical EO investigations.

Note

> The competencies listed above are embedded with the training course specified within paragraph 2.6 or embedded in the pre-requisites for the courses listed. Therefore personnel who have met the requirements at 2.6 have also met the requirements of paragraph 2.7.

Guidelines for the Issue of Certificates of Safety

2.10 If the need for a Certificate of Safety arises, an officer authorised to issue such a certificate is to examine the EO and be satisfied that the EO is fit for handling, storage and/or transportation, as appropriate. A Certificate of Safety is to be issued only if the condition of the EO is assessed as safe and is expected to remain so for the specified period required. The certificate should not normally be valid for more than three months.

Note

> It is expected that the 3 months period should be enough to either repair or dispose of the item in question. Should a greater timeframe be required to determine by the Australian Defence Force Logistics Manager (ADFLM) to resolve the issue, it is expected that the item is reassessed and a new SG 131 raised.

2.11 EO for which a certificate is issued is normally to be packed in its authorised package as specified in Topic -025 of the item publication, and the package appropriately marked and labelled in accordance with the requirements of Regulation 2.3 Procedure 4. In an emergency EO may be transported in other than its authorised package provided approval to do so is obtained from the nearest JLU EOS office. The manager of the JLU EOS Office should consult the Secretary Explosives Storage and Transport Committee (ESTC) at the Directorate of Ordnance Safety if there is any concern about the hazard classification of the repackaged EO.

2.12 Where the officer examining the EO has any doubts as to its continued safety the nearest JLU EOS Office must be contacted for further guidance. In the interim, the EO is not to be handled.

2.13 Where the EO is assessed as unsafe to move, the nearest JLU EOS Office is to be contacted for arrangements to be made for the attendance of an Explosive Ordnance Disposal (EOD) team. Subsequent control of the movement and disposal of the EO is an EOD responsibility and a Certificate of Safety is not required.

Distribution of Certificate of Safety

2.14 The Certificate of Safety is to be distributed one copy each as follows:

a. Attached to the EO package;

b. Consignee (forwarded with the driver);

c. Consignor; and

d. Originator of Certificate, i.e. Certifying Officer.

Approval of Local Procedures

2.15 Where local procedures are raised to supplement this procedure, they are to be approved by the Manager EO Technical Services in the Directorate of Explosive Ordnance and Services.

Annexes:
A. Instructions for Completion of Form SG 131 - Certificate of Safety for Handling, Transport and Storage of Defective Explosive Ordnance

ANNEX A

INSTRUCTIONS FOR COMPLETION OF FORM SG 131 - CERTIFICATE OF SAFETY FOR HANDLING, TRANSPORT AND STORAGE OF DEFECTIVE EXPLOSIVE ORDNANCE

1. Certificates of Safety are to be completed as follows:

a. Cross the applicable box for the reason for the certificate (see Regulation 3.1).

b. Allocate local certificate number.

c. Enter defect report details if applicable.

d. Enter requisition number if applicable.

e. Enter Consignee/Consignor details.

f. Enter Certificate Expiry Date (see Regulation 3.1 Procedure 2).

g. Complete columns relating to store details.

h. Enter in Remarks column as appropriate:

(1) Package details if not packed in accordance with Topic - 025 of the item publication, together with authority.

(2) Any special markings on package.

(3) Reason for assessing the items ‘Safe’.

i. In Special Instructions box enter any precautions to be observed during handling, storage or transportation.

j. Complete Certifying Officer, Name, Designation and Date blocks.

k. Distribute certificate (see Regulation 3.1 Procedure 2).

REGULATION 3.2 - MIXING RULES FOR TRANSPORT

General Overview

2.1 In accordance with the Transport of Dangerous Goods – Model Regulations (UN system), all EO is allocated a Hazard Classification Codes (HCC) which defines the hazard division and compatibility group. Transporting each kind of EO separately would enhance safety, but considerations of practicability and economics preclude such an ideal. In practice, a proper balance between safety and practicability necessitates a degree of mixing when transporting EO. The extent of such mixing in transport is determined by the compatibility of the EO. EO are considered to be compatible if they can be transported together without significantly increasing either the probability of an accident or, for a given quantity, the magnitude of the effects of such an accident.

Requirements

2.2 Mixing and aggregations rules for EO transported by:

a. Road and rail, and on inland waterways must in accordance with the Australian Explosives (AE) Code as amended by the Explosives Transport Regulations (ETR).

b. Civil Air must be in accordance with IATA.

c. Service Air must be in accordance with Australian Air Publication 3631.001 Books 1 and 2 - RAAF Manual of Air Movements

d. Civil/Commercial Shipping (excluding inland waterways) must be in accordance with IMDG Code and AS 3846 – 2005.

e. HMA Warships (excluding inland waterways) – where a ship's magazine meets warship magazine standards defined in Australian Book of Reference (ABR) 862 Volume 2 - Maritime Explosive Ordnance Safety Manual the RAN SHIPCAT mixing procedures in Australian Book of Reference (ABR) 862 Volume 2 - Maritime Explosive Ordnance Safety Manual are to apply; where ship's magazines do not meet warship magazine standards, or where EO is carried in cargo spaces of a naval vessel, the IMDG Code and AS 3846 – 1998 are to apply.

Responsibilities

2.3 Personnel involved in all elements of the transportation of EO are to ensure that all EO and EO Natures within the load are compatible for transport.

Procedures

2.4 Procedure 1 – Mixing Rules for Transport by Road and Rail contains the procedures to implement the requirements mixing and aggregation of EO by road and rail. The References listed at paragraph 2.2 b – e are to be referred to for procedures by other modes of transport.

PROCEDURE 1 - MIXING RULES FOR TRANSPORT BY ROAD AND RAIL

General

1.1 For practical needs in transport by road and rail, there may be a requirement to mix Explosive Ordnance (EO) of different Hazard Divisions (HD) and different CompatibilityGgroups (CG). The safety of EO would be ensured more easily if each kind was transported separately, but this ideal practice is not always practicable. A proper balance of the interest of safety against the other relevant factors must be observed.

1.2 Different kinds of EO may be mixed for transport by road and rail only if they are compatible. They are considered to be compatible if they may be transported together without significantly increasing either the probability of an accident or, for a given quantity, the magnitude and effects of such an accident.

Purpose

1.3 This procedure provides for Department of Defence Explosives Regulations Regulation 3.2.

Mixed (Dangerous) Goods Loads

1.4 EO must not be loaded together with other dangerous or other goods which may increase the danger e.g. flammable, oxidising, corrosive and combustible materials. Adjacent cargo spaces not containing EO may be loaded only with non-flammable goods.

1.5 Small quantities (up to a maximum of 300g) of matches, packed in approved outer packs in a CTE, may be mixed in transport with other items of Class 1 Dangerous Goods (Explosives). Within the mixed load, the maximum distance possible must be maintained between the CTE containing the matches and all other Class 1 cargo. The CTE must be stowed in a separate compartment to Class 1 Dangerous Goods in the load. The following are approved CTEs:

a. DSN 8140-66-067-8112 Case Transporting Explosives (CTE) No 3.

b. DSN 8140-66-067-8113 Case Transporting Explosives (CTE) No 4.

Mixed Explosive Ordnance Loads—Hazard Divisions

1.6 It is permissible to load EO of different HD into the same vehicle or rail carriage, providing the conditions of paragraph 1.7 are met. The HD of the mixed load, as a whole is to be determined as for the requirements given in table 1–1.

Hazard Division	**1.1**	**1.2**	**1.3**	**1.4**	**1.5**	**1.6**
1.1	1.1	1.1	1.1	1.1	1.1	1.1
1.2	1.1	1.2	1.1	1.2	1.1	1.1
1.3	1.1	1.1	1.3	1.3	1.1	1.1
1.4	1.1	1.2	1.3	1.4	1.5	1.6
1.5	1.1	1.1	1.1	1.5	1.5	1.1

1.6	1.1	1.1	1.1	1.6	1.1	1.1

Table 1-1: Transport by Road and Rail—mixing and aggregation rules for hazard divisions

Mixed Explosive Ordnance Loads—Compatibility Groups

1.7 The mixing of EO of different compatibility groups in road and rail transport is permitted as shown in table 1–2.

Compatibility Group	A	B	C	D	E	F	G	H	J	K	L	N	S
A	(a)												
B		X(j)	X(b)(c)(j)	X(b)(c)(j)	X(b)(c)(j)	X(b)(c)(j)	X(b)(c)(j)						X(i)(j)
C		X(b)(c)(j)	X(j)	X(j)	X(j)	X(d)(j)	X(f)(e)(j)					X(d)(e)(j)	X(i)(j)
D		X(b)(c)(j)	X(j)	X(j)	X(j)	X(d)(j)	X(f)(e)(j)					X(d)(e)(j)	X(i)(j)
E		X(b)(c)(j)	X(j)	X(j)	X(j)	X(d)(j)	X(e)(j)					X(d)(e)(j)	X(i)(j)
F		X(b)(c)(j)	X(d)(j)	X(d)(j)	X(d)(j)	X(j)	X(d)(j)					X(d)(j)	X(i)(j)
G		X(b)(c)(j)	X(f)(e)(j)	X(f)(e)(j)	X(e)(j)	X(d)(j)	X(j)					X(e)(j)	X(i)(j)
H								X					X(i)(j)
J									X				X(i)(j)
K										X(g)			
L											(h)		
N			X(d)(e)(j)	X(d)(e)(j)	X(d)(e)(j)	X(d)(j)	X(e)(j)					X(j)	X(i)(j)
S		X(i)(j)	X(i)(j)	X(i)(j)	X(i)(j)	X(i)(j)	X(i)(j)	X(i)(j)	X(i)(j)			X(i)(j)	X(i)(j)

Note

(X) Mixing Permitted

(a) Compatibility Group A substances must not form mixed loads with substances or articles of other compatibility groups and may only be transported with the approval of and subject to conditions imposed by the Competent Authority.

(b) Compatibility Group B articles should constitute a separate load but fuzes of Compatibility Group B may be carried with their associated unfuzed articles. In this case, the NEQ of the load of fuzes in Compatibility Group B is to be aggregated with that of the associated article and the whole treated as Compatibility Group F.

(c) Small quantities (up to a maximum NEQ of 60 gm) of detonators in Compatibility Group B, packed in case transporting explosives (CTE), may be mixed in transport with separately packaged articles of Compatibility Groups C, D, E and F, or those articles of Compatibility Group G which are not liable to give rise to loose explosive powder. The aggregate load is to be treated as Compatibility Group F. Within the mixed load, the maximum distance possible must be maintained between the CTE containing the detonators and all other groups. Also, individual packages of detonators within the CTE should also be separated from each other if space and method of packing permits. The following are approved CTEs:

i. DSN 8140-66-067-8112 Case Transporting Explosives (CTE) No 3.
ii. DSN 8140-66-067-8113 Case Transporting Explosives (CTE) No 4.

(d) Compatibility Group F articles may be mixed in transport with articles of Compatibility Groups C, D, E or N or those articles of Compatibility Group G which are not liable to give rise to loose explosive powder. The aggregate load is to be treated as Compatibility Group F.

(e) All articles of Compatibility Groups C, D, E or N, or those articles of Compatibility Group G, which are not liable to give rise to loose explosive powder, may be mixed in transport. However, when articles of Compatibility Groups C, D or E, are mixed with articles of Compatibility Group N, the Compatibility Group N articles should be considered as having the characteristics of Compatibility Group D.

(f) Substances of Compatibility Groups C, D or G, packaged so as not to give rise to loose powder and which are less sensitive to mechanical stimuli than dry RDX, may be mixed together in transport. The aggregated load is to be treated as a single group and assigned to the group appropriate to the predominate characteristic of the combined load. (*See also* note k).

(g) Compatibility Group K articles must always be transported separately from all articles of other compatibility groups. Additionally, some articles may require separate transport from other articles within the group.

(h) Compatibility Group L substances and articles must always constitute separate loads and must not be mixed with other Compatibility Group L substances or articles.

(i) Inert items and Compatibility Group S substances and articles may be transported with substances and articles from any other compatibility group, except Compatibility Groups A, K and L, without penalty. (*See also* note k).

(j) Articles of HD 1.4 may be mixed in transport with articles of Compatibility Groups B, C, D, E, F, G, N or S without penalty.

(k) Substances and articles may be mixed together in transport, subject to the appropriate mixing safeguards, provided that the substances are in substantial, sift-proof packages.

Table 1-2: Road and rail transport of explosive substances and articles—rules for mixing of compatibility groups

REGULATION 4.1 - STORAGE CONDITIONS FOR EXPLOSIVE ORDNANCE

General Overview

1.1 Explosive Ordnance (EO) should be stored in accommodation designated for that purpose to minimise the risk of injury to life and property in the event of an explosion or fire, and to prevent deterioration of the EO.

Requirements

1.2 All EO, under control of Defence, must be stored and handled in accordance with the following requirements of this regulation.

General Principles of Storage

1.3 **Hazard Classification.** All EO intended to be stored is to be classified in accordance with the requirements of Regulation 2.1.

1.4 **Explosive Limits.** All EO facilities are to be licensed in accordance with the requirements of Regulation 5.2. The Net Explosive Quantity (NEQ) of EO stored in any EO facility is to be strictly controlled in a manner which will ensure compliance with the explosive limits permitted by the Explosive Limit Licence. The explosive limits permitted on the licence must never be exceeded. For large quantity facilities, an Explosive Contents Board is required to record the NEQ stored in the facility at any given time.

1.5 **Use of Explosive Ordnance Storehouses.** EO Storehouses (EOSH) are to be used for the storage of EO, including explosive components, and should not be used for the storage of unrelated non-explosive stores. EO storehouses are not to be used for the processing or maintenance, including repacking, of EO.

1.6 **Packaging.** EO packages and containers are to be marked in accordance with Regulation 2.3. Packages are to be in good repair, be free from loose dirt, grit or other contamination before being stored. Any broken or damaged packages are to be repacked before being accepted into an EOSH, unless the damage is so slight and it does not adversely affect the protective qualities of the package.

1.7 **Dispersal of stock.** Stock of each nature are where possible, to be held in not less than two EO facilities in order to reduce the risk of the items being destroyed in event of a fire or explosion.

1.8 **Storage by Lot Number.** EO of the same Lot Number should be stored together in clearly identifiable stacks. Where multiple Lot Numbers of the same item of EO is stored, each Lot Number is to comprise of a separate stack. Oldest lot numbers are to be issued first. EO Stack Records are to be attached to each stack. Packages are to be stacked, as far as possible, so that identification markings can be seen without disturbing the stack. Fraction boxes are to be placed in a conspicuous position and clearly marked ‘FRACTION’.

1.9 **Storage in Unit Loads.** Stocks of EO, associated non-explosive dangerous goods and associated components are, as far as practicable, to be stored in unit loads.

1.10 **Segregation in Storage.** EO in any stack or building is to be arranged so that it can be readily identified by both store type (Name, NSN, Hazard Classification etc) and condition (Serviceable, Restricted-in-Use, Unserviceable etc). EO is to be stored separately according to its Condition Code and identified by an appropriate stack card.

1.11 **Special Precautions.** EO that requires special precautions during storage must be store in accordance with those requirements. Special precautions may include, but are not limited to, temperature and humidity conditions, orientation with an EOSH, increased Quantity Distance (QD) due to artificial aging, etc.

1.12 Inert and Instructional EO. Inert and instructional EO is not to be stored in an EO storehouse with ‘live’ EO of similar types. Preferably, they are to be stored in a separate, dedicated, suitable non-explosive storehouse.

1.13 Non-Explosive Components. Non-explosive components may be stored in the same EO Storehouse as their associated explosive items.

1.14 Access Aisles. Access aisles are to be delineated by painted lines on the floor of the building. The lines are to be white in colour and at least 75 mm in width. The following access aisles are to be provided for:

a. **Inspection Aisles.** Inspection aisles are to be maintained to allow ease of inspection of, and access to, storehouse walls and stacks of EO.

b. **Working Aisles.** Working aisles are to be maintained to allow access by MHE or personnel to stacks.

c. **Separation Aisles.** Separation aisles are to be maintained to allow separation between normal stock, stock which is earmarked for issue, and / or stock which is unusable.

1.15 Safety Exits. Safety exits in an EOSH are not to be blocked or obstructed. When work is being conducted, doors should not be fastened with other than approved quick-release devices which must be maintained in good working order. Where quick-release devices are not fitted, the doors must be unlatched or open. All doors should be outwards opening.

Conditions of Storage

1.16 EO can be adversely affected by environmental conditions such as extremes of temperature, rain and electro-explosive hazards. Preferably, EO should be stored inside an EOSH, however this is not always possible. Some form of cover must be provided and the storage conditions monitored to ensure that the storage temperature limitations are not exceeded. When covered storage is limited, consideration is to be given to the factors that affect the priorities for allocating covered storage.

1.17 Open Storage. When EO is stored in the open, such as field storage, the stacks of EO are to be provided, whenever possible, with covers or improvised shelters.

1.18 Temperature. Certain explosive substances, whether in bulk or in EO, are adversely affected either chemically or physically by extremes of temperature, and the most suitable storage accommodation available is to be used so that such EO is maintained in a serviceable condition. Stores that have additional special temperature restrictions are to comply with those restrictions. Temperature records may be required to be maintained.

1.19 Restricted Humidity. Restricted humidity conditions are those required in EO workshops where inspection or work is being performed involving the exposure of hygroscopic explosive substances and materials. Such conditions refer to the control of the Relative Humidity (RH) of the atmosphere which, for the purpose of these instruction and their related procedures, is based on a standard of 80 per cent RH at an air temperature of 16ºC.

1.20 Ventilation. Storage within a well ventilated environment may assist with the control of temperature. EOSH’s with ineffective ventilation should be ventilated by opening doors and ventilators, if fitted, when atmospheric conditions are favourable. In some instances, EO workshops and storage buildings may require climate control to maintain an acceptable environment.

1.21 Climate Control. Where climate control plant or temperature control is installed, and set conditions of temperature and humidity can be established, the ventilation procedures are not required.

1.22 Radio Frequency and Electrostatic Hazards. Electrically initiated EO can be inadvertently initiated by radio frequency and electrostatic charges. Such items are, where possible, to be stored in a totally enclosed metallic container. Storage is to comply with the applicable safety distance to ensure protection from the emitters.

1.23 Explosive Ordnance containing Phosphorus and Phosphides (Compatibility Group H). On exposure to air, white phosphorus will inflame and could cause a spread of fire to adjacent EO. Compliance with the special storage requirements for this compatibility group is essential. See paragraphs 1.40 – 1.46 for the special storage requirements.

Handling of Packaged Explosive Ordnance

1.24 General Handling Precautions. All EO is to be handled with care at all times. When packages are moved they are to be lifted unless utilising a mechanical handling device such as a gravity conveyor roller. When utilising a roller, care is to be taken to ensure that the packages are not able to collide with each other. When stacking, packages are to be placed flat and not on one end, side or corner first.

1.25 Handling Projectiles. When handling projectiles, either packaged or unpackaged, the utmost care is to be exercised to ensure that driving bands and fuzes are not damaged or distorted etc. The forward end of one projectile should not be allowed to collide with the base of another.

1.26 Damaged EO. Any EO damaged during handling is to be segregated for priority examination by appropriately qualified inspection staff familiar with the nature of the EO in question.

1.27 Mechanical Handling Equipment (MHE). Only mechanically and electrically operated handling equipment which conforms to approved constructional specifications and limitations are permitted in EO areas.

1.28 Pallet Handling. Palletising may be adopted for EO of compatibility groups B, C, D, E, F, G, N, and S (may also be used with compatibility group H provided the specific limitations are met). Pallets may be of any suitable material however, only the approved pallet specified in the unit load specification is to be used as part of the unit load. Care is to be taken to ensure that packages and their contents are not damaged by over tensioning of the strapping. Packages may overhang provided they are stable in the unstrapped condition. Packages on a pallet are to be arranged, where possible to obtain a bonded stack. Stacking heights are not to exceed specified heights.

Stacking of Packaged Explosive Ordnance

1.29 Method of Stacking. Packaged EO is to be stacked in such a manner as to permit free circulation of air around each package so all stacks are ventilated. Packages are to be stacked on battens that allow free flow of air beneath the stacks. Battens need not be used where pallet stacking is being utilised. Battens material and dimensions are to be suitable for their intended use, however battens and other dunnage should not introduce additional grit or other contaminants into the storehouse.

1.30 Space around Stacks. Stacks should be positioned so that they are at least 1 metre from doorways to protect the stack from the elements. A minimum all round gap of 50 mm is to be maintained between each individual stack of pallets. Aisles are to be maintained in accordance with paragraph 1.14. Pallets are not to be stacked more than four deep from a working aisle. Where there is a working aisle on each side of a stack, pallets may be nine deep.

1.31 Restacking. Whenever restacking is necessary, the packages previously bearing the most weight should be repositioned on the top of the stack.

Stack Heights

1.32 Separation between Ceiling and Top Package or Pallet. The following minimum separation distances are to be upheld:

a. **Regular storehouse.** A minimum separation distance of 300 mm is to be maintained between the top package or pallet and the ceiling of the building.

b. **Igloo designed buildings.** The stacking height is to provide a minimum of 600 mm clearance from the top of the stack to the roof.

c. **Traversed building.** The EO is to be stacked no higher than 600 mm from the top of the traverse.

1.33 Unpalletised EO. Unpalletised EO packages are to be stacked no more than two packages wide. Bulk stacking of EO is not permitted. The maximum permitted stacking heights for individual package types are as follows:

a. **Rectangular Packages.** Rectangular metal or wooden packages are to be stacked on their base to a height not exceeding 3.7 metres with the following exceptions:

(1) Packages containing compatibility group B EO are not to exceed 1.5 metres.

(2) Packages containing compatibility group H EO are to comply with the instruction for either Thick or Thin Skinned compatibility group H EO instruction, which ever is relevant to the store being stacked. See paragraph 1.44a and 1.45a for further details.

b. **Cylindrical Packages.** The maximum stack height is not to exceed 3.7 metres. Cylinders are to be stacked on their sides in tiers with any reinforcing bands coinciding throughout the stack. The following tier heights are not to be exceeded:

(1) Cylinders under 25 kg in weight – 8 tiers, and

(2) Cylinders 25 kg to 45 kg in weight – 5 tiers.

c. **Unboxed Shell.** Unboxed shells are to be stacked on their sides in tiers. The following tier heights are not to be exceeded:

(1) Up to 140 mm – 15 tiers,

(2) 140 mm to 175 mm – 11 tiers,

(3) 175 mm to 300 mm – 8 tiers, and

(4) Over 300 mm – 5 tiers.

1.34 Stability of Stacks. All stacks are to be stable. Stability of the stacks is to be achieved by either bonding of the packages, the use of battens or open stacking methods.

1.35 Stability of Unboxed Shell. Unboxed filled shell, except shell with either copper or steel based covers, are to be stored on their bases on wooden dunnage, except when racks are installed, or where local conditions render it necessary to store them on their sides.

1.36 Palletised EO. Stacking heights for loaded pallets are to be limited to:

a. 3.7 metres for pallets with battens on the underside which result in point loading of the contents of the lowest pallet, or

b. 5 metres for pallets with a flat underside which distributes the weight evenly across the contents of the lower pallet, or

c. The height permitted by the stability of the stack when the pallet is fitted with supporting posts which take the weight instead of imposing it on the contents of the pallets below, or

d. Stacking heights as detailed in paragraphs 1.44b and 1.45b for EO filled white phosphorus.

1.37 Metal Box Pallets. The maximum stack height of box pallets is not to exceed four pallets.

1.38 Packaged Non-Explosives. A maximum stack height of 5 metres is permitted for packaged non-explosives with the exception of cylindrical tail units. Cylindrical tails units, when stored vertically on their bases are not to exceed more than six tiers. When cradle stacked, cylindrical tail units are not to exceed four tiers.

1.39 Guided Weapons. For guided weapons, stacking heights and other handling criteria such as vehicle loading configurations, are usually identified in weapons specific manuals.

Explosive Ordnance containing Phosphorus and Phosphides (Compatibility Group H)

1.40 General Storage Requirements. Compatibility group H EO is to be stored separately (segregated) from other types of EO. EO containing phosphorus or phosphides is to be stored in as cool a place as possible and is not to be exposed to the sun. EO storehouses containing EO filled with Red Phosphorus are to be ventilated at least weekly.

1.41 Leaking of Compatibility Group H EO. Leakage of compatibility group H EO is readily detected by a strong odour of the toxic gas phosphine. In the event of a leakage, the leaking store is to be immersed in water. Therefore, a good supply of water is to be kept adjacent to, any building where compatibility group H EO is held as so the leaking round can be quickly immersed in water. The supply of water is to be housed in a container of suitable size to submerge the whole of the largest EO package.

1.42 Inspection for Leaking Stores. Regular external inspections of each pallet or loose package of compatibility group H EO is to be carried out at monthly intervals. Inspections are to be recorded.

1.43 Tools to Cut Banding. Suitable tools to cut the banding of pallets are to be readily available in a prominent position in storehouses used to store compatibility group H EO.

1.44 Storage of Thick-Skinned Compatibility Group H EO. Natures of thick-skinned compatibility group H EO is to be stored as follows:

a. **Unpalletised.** Unpalletised packages are to be stacked to a height not exceeding 2 metres and with an ease of access to permit the prompt removal of any package which shows signs of phosphorus leak.

b. **Palletised.** Palletised packages are to be stacked up to three pallets high, provided MHE is readily available. Each row of pallets is to be no more than two pallets wide from an inspection or working aisle. Ideally all pallets are to be directly accessible by MHE however, in worst case, the maximum number of pallets to be moved, in order to reach the least accessible pallet is not to exceed six.

1.45 Storage of Thin-Skinned Compatibility Group H EO. Natures of thin-skinned compatibility group H EO is to be stored as follows:

a. **Unpalletised.** Unpalletised packages are to be stacked to a height not exceeding 1.5 metres and with an ease of access to permit the prompt removal of any package which shows signs of phosphorus leak.

b. **Palletised.** Palletised packages are to be stacked not in excess of one pallet high. Each row of pallets is to be no more than two pallets wide from an inspection or working aisle and with an ease of access by either hand or MHE, to permit the prompt removal of any package which shows signs of phosphorus leak.

1.46 Temperature Limitations. EO filled with white phosphorus is to be stored oriented to the following positions if the ambient temperature is likely to exceed 44ºC:

a. Grenades – fuze end upper most; and

b. Separate, fixed and semi-fixed ammunition natures and free flight rockets – nose end upper most.

Stacking of Unpackaged Explosive Ordnance

1.47 Method of Storage – General. Unpackaged EO may be stored either vertically resting on transit bases, provided there is adequate stability or horizontally, cradle-stacked in tiers.

1.48 Unpackaged Projectiles. Normally unpackaged projectiles are to be stored in accordance with Topic -025 of the item publication. Should the need arise to stack projectiles unpackaged, the following method is to be employed:

a. The items are to be arranged in stacks so that no weight bears on driving bands.

b. The bottom tier is to be placed on wooden battens or pallets of sufficient thickness to prevent the driving bands coming in contact with the floor.

c. The end projectiles of each tier are to be secured by chocks fixed to the battens.

d. Battens are to be used between tiers.

1.49 Unboxed filled projectiles except projectiles with either copper or steel base covers, are to be stored on their bases on wooden dunnage.

1.50 Stacking Heights. Unpackaged EO and non-explosive dangerous goods may be stacked to a maximum height of three metres except as follows:

a. High Capacity store such as depth charges are normally to be stored in single tiers. Approval may be granted in some circumstance to stack to a maximum of 3 tiers.

b. Stacking height for loose projectiles is not to exceed 1 metre.

Inter-Service Storage of EO.

1.51 Storage facilities may be provided free of cost to other Services subject to the following requirements:

a. There is sufficient physical and explosives licence capacity at the proposed Holding Establishment.

b. The EO is stored at owner's risk.

c. The Officer-in-Charge of the Holding Establishment is authorised to destroy any item which is considered to be in a dangerous condition and further storage could jeopardise the safety of personnel, stock or property.

d. Any direct charges specifically incurred by the Holding Service in providing storage, mechanical handling equipment or manpower to meet such requirements are recoverable and are agreed between the Owner Service and the Holding Service.

e. EO is to be listed on the statutory accounts register on the Computer Support for Armament (COMSARM) IT System to ensure explosives licensing and compatibility compliance, and that EO is not listed as surplus during mandatory Stocktake Programs. The Owner Service is to be entered on COMSARM. Where the Holding Establishment is not serviced by COMSARM, the EO holding is to be accounted for using the establishment's normal accounting system.

Storage of EO at Defence Establishments for Non-Defence Organisations.

1.52 Storage facilities may be provided to Commonwealth or State Government departments, Foreign Military Forces or commercial organisations, subject to the following requirements:

a. There is sufficient physical and explosives licence capacity at the proposed Holding Establishment.

b. The EO can be safely stored in accordance with the requirements of this manual.

c. The EO is stored at owner's risk.

d. The Officer-in-Charge of the Holding Establishment is authorised to destroy any item which is considered to be in a dangerous condition and further storage could jeopardise the safety of personnel, stock or property.

e. Charges specifically incurred by the Holding Establishment in providing resources to meet such requirements should be recovered. Storage services can be provided to a commercial profit making entity at normal market rates provided those services cannot be provided by another commercial entity. Such charges are to be agreed between the Owner Authority and Defence through the Administrative Headquarters for the Holding Establishment.

f. EO is to be listed on the statutory accounts register on the Computer Support for Armament (COMSARM) IT System to ensure explosives licensing and compatibility compliance, and that EO is not listed as surplus during mandatory Stocktake Programs. The Owner Authority is to be entered on COMSARM. Where the Holding Establishment is not serviced by COMSARM, the EO holding is to be accounted for using the establishment's normal accounting system.

Responsibilities

1.53 Explosive Materiel Branch in the Capability, Acquisition and Sustainment Group (CASG) is responsible for the promulgation of all storage conditions and precautions for all in-service articles and substances, including items being introduced or trialled before being introduced.

1.54 EMB is responsible for the establishment of procedures for the preparation, testing, approval, amendment and control of unit load specifications.

1.55 The owner of the EO stored within an EO Storage area is to ensure compliance with this regulation and the associated procedures.

1.56 The establishment storing EO for its own use or on behalf of another service/organisation is to ensure compliance with this regulation and the associated procedures.

Procedures

1.57 Procedures to implement the requirements of this regulation are:

a. Procedure 1 – General Rules for Storage

b. Procedure 2 – Storage Conditions

c. Procedure 3 – Priority for Covered Storage

d. Procedure 4 – Limits of Temperature Reporting

e. Procedure 5 – Environmental Control

f. Procedure 6 – Restricted Humidity Conditions

g. Procedure 7 – Handling of Packaged Explosive Ordnance

h. Procedure 8 – Stacking of Packaged Explosive Ordnance

i. Procedure 9 – Stacking of Unpackaged Explosive Ordnance

j. Procedure 10 – Related Non-Explosives – Storage and Inspection

k. Procedure 11 – Inter-Service Storage of Explosive Ordnance

l. Procedure 12 – Storage of Explosive Ordnance at Defence Establishments for Non-Defence Organisations

PROCEDURE 1 - GENERAL RULES FOR STORAGE

General

1.1 The overriding principle in the storage of Explosive Ordnance (EO) is that EO is to be stored in special accommodation; where suitable storage facilities are not adequate or are not immediately available, temporary arrangements are to be made which will minimise the risk of injury to life and property in the event of an explosion or fire, and to prevent deterioration of the EO. Any temporary arrangements are to comply with principles prescribed in this manual.

1.2 The normal basis for the distribution of EO in storage is the United Nations Classification System for Dangerous Goods Class 1 (Explosives) - see Regulation 2.1 Procedure 1 for details. This classification separates Service conventional EO into 13 compatibility groups, each group containing all EO with similar characteristics. In the interests of safety, EO with dissimilar characteristics is to be kept apart in storage if the hazards attaching to one group are not to be aggravated by the presence and properties of certain others. For this reason, some groups are always to be stored alone; certain others with similar but not necessarily identical properties may, if necessary, be stored together.

1.3 Details of compatibility groups that may or may not be stored together are shown in Regulation 4.2 Procedure 1. The classifications shown are for EO in its approved packages or, if unpackaged, when fitted with its approved transit devices. A change in packaging or transit device(s), or removal from packages or of transit device(s) can affect these classifications.

Purpose

1.4 This procedure prescribes the general principles for the storage of Defence EO.

Dispersal of Stock

1.5 Stocks of each item are if possible, to be held in not less than two EO facilities in the same depot or in separate depots in order to reduce the risk of the total stocks of an item being destroyed in the event of a fire or explosion. Dispersal in this way is desirable in all establishments, but is essential at main storage depots where two-point dispersal is to be regarded as the absolute minimum acceptable and where wider dispersal should be the aim.

Storage by Lot Numbers

1.6 Subject to the provisions of paragraph 1.5, EO of the same lot number should be stored together in clearly identifiable stacks as far as practicable. Where multiple lot numbers of the same EO are held, each lot number is to comprise a separate stack, unless this is not possible due to the lack of storage space. Oldest lots should be most accessible, as these are to be issued first.

Explosives Limits

1.7 All EO facilities, whatever their purpose eg storage, workshop, EO loading areas on airfields etc, are to be licensed by the use of an Explosives Limit Licence (ELL) before being taken into use - see Regulation 5.1 Procedure 3 for details.

1.8 No EO facility, whether located at an EO storage depot or user establishment, is to be planned to contain more than 75 000 kg NEQ without the prior approval of the Licensing Authority in the Directorate of Explosive Ordnance Services.

1.9 The Net Explosives Quantity (NEQ) of EO stored in any type of EO facility is to be strictly controlled in a manner which will ensure that the explosives limits permitted by the ELL are never exceeded. To assist in this control appropriate storage planning and monitoring is to be undertaken. For large quantity facilities an Explosives Content Board is required to record the NEQ stored in the facility at any given time (See Regulation 4.4 Procedure 2).

Storage of Other Equipment or Material in Explosive Ordnance Storehouses

1.10 Storehouses used for the storage of EO are not to be used for the storage of other equipment or material.

Storage of Commercial Explosives and Ammunition

1.11 Commercial explosives and ammunition procured through normal service channels may be stored with Service EO provided those items form part of the Defence inventory and their Hazard Classification Codes have been confirmed by the Explosive Storage and Transport Committee of the Directorate of Ordnance Safety in accordance with Regulation 2.1 Procedure 1.

Storage in Unit Loads

1.12 Stocks of EO, non-explosive dangerous goods and associated components are, as far as practicable, to be stored in unit loads.

Storage in Transit Explosive Ordnance Storehouses

1.13 In buildings authorised as transit Explosive Ordnance Storehouse (EOSH), EO of different compatibility groups may be mixed in the same way as is permitted for the appropriate mode of transport. If it is necessary to open packages, for acceptance, receipt or issue or for identification, verification of quantity, repack or other process, this should be done in an adjacent building or separate compartment of the same building; only one nature should be present in this building or compartment at any one time. Remarking of the outer packages and sorting of packages may be carried out in the main transit building. Irrespective of the quantities of each Hazard Division (HD) present at any time the overall explosive limit applied to the building should be that for the HD which permits the least net explosives quantity for the available QD.

Segregation in Storage

1.14 EO in any stack or building is to be so arranged that it can be readily identified. The serious consequences of confusion, especially under active service conditions are obvious. To this end EO is to be stored separately according to its Condition Code, identified by a stack card and when required is to be appropriately marked, eg Red Card is to be displayed on the stock.

Special Precautions

1.15 Some EO and explosive substances require special precautions, additional to those applicable to EO in general. Examples of such stores and substances are given in Regulation 4.1 Procedure 4. The special precautions required for each item of EO and explosive substance can be obtained in the relevant item publication.

Suspect or Damaged Explosive Ordnance for Disposal

1.16 EO that is, or is suspected of being, other than serviceable or safe, is to be stored in accordance with the requirements of Regulation 4.2 Procedure 2 pending disposal.

Experimental Explosive Ordnance

1.17 EO that is in the experimental stage is to be stored in accordance with the requirements of Regulation 4.2 Procedure 3. Experimental stores are to be recorded in a separate register and, to ensure they retain their identity at all times, their packages and the contained items are to be marked with an identification symbol to enable each item to be associated with and, if unused, returned to its correct package.

Rocket Propelled Ammunition

1.18 Rocket propelled ammunition, which is potentially propulsive, is to be stored oriented within an EO storehouse so that the direction of propulsion faces away from the bulk of other EO within the storehouse, ie with heads facing away from other EO, preferably to traverses.

Inert and Instructional Explosive Ordnance

1.19 Inert EO such as inert filled, drill, dummy, servicing rounds, solid shot projectiles and empty items, and instructional EO is not to be stored in an EO storehouse with 'live' EO of similar types, eg inert filled, drill, servicing rounds etc of 20 mm cannon ammunition are not to be stored in the same storehouse as ammunition of 20 mm HE, Practice or any other variant. This is essential to prevent inadvertent mixing of filled and empty stores. Preferably, they are to be stored in a separate, dedicated, suitable non-explosives storehouse and afforded the same security and accounting requirements as live EO. Refer to Defence Security Principles Framework (DSPF) for the security and accounting requirements. Subject to security considerations this storehouse may be outside the EO area.

Empty Packages

1.20 Empty EO packages are not normally to be stored in EO storehouses containing EO. A separate dedicated site or building is to be allocated, ideally outside the EO area. Detailed instructions for the storage and transport of empty EO packages are at Regulation 2.3 Procedure 1.

Planning of Storage Space Layout

1.21 With the diversity of storehouses used for the storage of EO, it is not considered practicable to provide specific floor layouts. However, in planning storage layouts for each building the following factors should be taken into account to provide maximum space utilisation:

a. general stacking criteria as set out in Regulation 4.1 Procedure 8;

b. the position and heights of doors, windows and fire exits;

c. building headroom and lifting facilities;

d. access for personnel and Mechanical Handling Equipment (MHE);

e. height of traverses; and

f. maximum permissible stacking heights.

1.22 Once the floor layouts for each storehouse have been decided, floors should, where practicable, be clearly marked to show storage bays, access aisles, clearways etc. Storage bays should be identified by letters to aid in stock location.

1.23 **Access Aisles.** Access aisles need to be planned for and marked to allow efficient access for MHE and personnel throughout storehouses. The aisles are to be delineated by painted lines on the floor of the building. The lines are to be white in colour, and at least 75 mm in width. The following access aisles spaces are to be provided for:

a. **Inspection Aisles.** Inspection aisles are to be maintained to allow ease of inspection of, and access to, storehouse walls and stacks of EO. They are to be a minimum of 600 mm in width and are to be maintained between the wall of the storehouse and stacks of EO. Where items are the same Lot and Nature and the items can be readily identified, there is no requirement for a separation of 600 mm between stacks. Stacks are not to intrude into inspection aisles, nor is any obstruction, eg strapping equipment, desks, empty pallets etc, to be placed in the aisle.

b. **Working Aisles.** Working aisles are to be maintained to allow access by MHE or personnel to stacks. Working aisles for MHE are to be of sufficient width to allow for the safe and efficient use of laden MHE on site. Stacks are not to intrude into working aisles, nor is any obstruction, eg strapping equipment, desks, empty pallets etc, to be placed in the aisle.

c. **Separation Aisles.** Separation aisles are to be maintained to allow separation between normal stock, and stock which is earmarked for issue or which is unusable.

These aisles are to be a minimum of one metre in width. Stacks are not to intrude into separation aisles, nor is any obstruction, eg strapping equipment, desks, empty pallets etc, to be placed in the aisle.

PROCEDURE 2 - CONDITIONS OF STORAGE

Purpose

2.1 This instruction details the general precautions to be observed in regards to storage of Explosive Ordnance (EO), depending upon the type and nature of EO and/or the conditions of storage in question.

Covered Storage

2.2 All EO and associated non-explosive stores and non-explosive dangerous goods are preferably to be stored under cover. Some stores are more vulnerable to the elements, and where covered storage is limited, the provisions detailed in Regulation 4.1 Procedure 3 are to be applied.

Open Storage

2.3 When it is unavoidable to store EO in the open, the stacks of EO are to be provided, whenever possible, with covers or improvised shelters that should fulfil the following criteria:

a. they protect the EO against rain and sunlight,

b. protective sides should be provided unless the roof overlaps sufficiently to prevent driving rain or direct sunlight affecting the EO,

c. all covers must be supported in such a way as to allow a minimum air gap of 500 mm so that a current of air can circulate over and around the stacks, and

d. materials should be, as far as possible, non-flammable or fire retardant.

2.4 Normal means of protection are as follows:

a. Tarpaulin,

b. Locally improvised structures suitable for the theatre of operations, and

c. Galvanised iron shelters.

2.5 All stacks are to be supported off the ground by battens/dunnage unless palletised.

Temperature

2.6 EO can be adversely affected by extremes of temperature. These stores, and the temperature restrictions applicable to them, are listed in Regulation 4.1 Procedure 4.

Radio Frequency and Electrostatic Hazards

2.7 Electrically initiated EO can be affected by radio frequency radiation and electrostatic charges and therefore, to prevent inadvertent ignition from these sources, the following precautions are to be observed:

a. In storage such items are, where possible, to be totally enclosed in metallic containers. Such containers, if not fitted with soldered on lids, are to have tight fitting metallic lids to ensure good electrical contact between lid and container. When so treated, the Electro Explosive Device (EED) may be considered screened.

b. When not screened by the packaging provided or, if unpackaged, electro-magnetic pick-up may be reduced by any one or more of the following:

(1) fitting metal blanking caps to firing circuit connector plugs or socket,

(2) bonding with cartridge clips,

(3) isolating the firing circuits,

(4) screening certain electric leads to prevent them acting as pick-ups; and/or

(5) fitting RF filters.

c. In all circumstances, EED are subject to safety distances from emitters – see DEOP 115 – Defence Electro-Explosive Hazards Manual.

Explosive Ordnance Containing Phosphorus and Phosphides (Compatibility Group H)

2.8 All personnel working in a building containing EO filled with white phosphorus are to exercise extreme vigilance to detect the leakage of phosphorus. On exposure to air, white phosphorus will inflame and could cause a spread of fire to adjacent EO. Instructions for the storage and stacking of phosphorus filled EO are given in Regulation 4.1 Procedure 8.

PROCEDURE 3 - PRIORITY FOR COVERED STORAGE

Introduction

3.1 Explosive Ordnance (EO) can deteriorate rapidly when exposed to the weather, particularly direct sunlight or rain. Some form of cover must be provided whenever possible and storage conditions monitored to ensure that storage temperature limitations are not exceeded. When covered storage is limited, consideration is to be given to the factors that affect the priorities for allocating covered storage.

Purpose

3.2 This instruction outlines factors for consideration when allocating covered storage for EO and recommends priorities for allocating such storage by way of a list of EO by generic designations.

General Considerations

3.3 Where there is insufficient covered storage accommodation available in storehouses, the following factors are to be taken into consideration when allocating such storage:

a. The inherent liability of particular kinds of EO to damage by exposure;

b. The design of the packages to resist exposure, and their condition;

c. The type of storage required by regulation, ie magazine or storehouse;

d. The availability of the EO in the theatre of operations and the prospects of reprovisioning;

e. The prevailing climate;

f. The available accommodation;

g. The need for the security of particular items, e.g. Small Arms Ammunition (SAA) and demolition explosives; and

h. The special risks from exposure if the condition of the EO is doubtful.

Recommended Priorities

3.4 When damage from exposure to the elements is the main consideration, the order of priority that should be followed when allocating covered storage for EO is as follows:

a. Water activated EO;

b. Guided weapons;

c. Anti-tank, ranging and spotting ammunition, phosphide filled stores;

d. Propelling charges and rocket motors;

e. Lachrymatory and pyrotechnics;

f. Fuzed projectiles and explosive heads;

g. Detonators, fuzes, and other initiating devices;

h. Demolition and bulk explosives;

i. Mine disposal weapon charges, prepared demolition charges and grenades;

j. Cluster (all types) and incendiary bombs;

k. Plugged High Explosive (HE) projectiles, bombs and similar stores;

l. Small arms ammunition;

m. Tail units; and

n. Other non-explosives and non-explosive dangerous goods.

Notwithstanding the priority as listed, the use of covered storage may vary depending on consideration of the factors at paragraph 3.3.

PROCEDURE 4 - LIMITS OF TEMPERATURE AND TEMPERATURE REPORTING

Introduction

4.1 Certain explosive substances, whether in bulk or in Explosive Ordnance (EO), are adversely affected either chemically or physically by extremes of temperature, and the most suitable storage accommodation available is to be used so that such EO is maintained in a serviceable condition.

Purpose

4.2 This instruction prescribes the temperature limitations applicable, during storage, to certain types of EO.

Application of Temperature Restrictions

4.3 In general, the restrictions given in paragraphs 4.4 to 4.10 inclusive, are to be taken as those which are desirable rather than mandatory; their application is not to involve the major alteration of existing buildings, but they are to be considered when constructing new buildings. If particular items of EO require specific temperature limits of a mandatory nature, the EO Design Certificate (EODC) for the item is to specifically identify that requirement[1].

Limits of Temperature

4.4 Where any EO is mentioned in more than one class of temperature restrictions, it is to be regarded as being in the class with the maximum restriction.

Minimum Temperatures

4.5 To prevent the exudation of nitro-glycerine, double base and triple base propellants and EO containing these types of propellants are not to be stored in conditions where the temperature in any part is liable to remain for a continuous period of more than 30 days, at or below 10º C.

4.6 When such conditions are likely to exist, artificial heating is to be installed unless the temperature of the storehouse rises above 13º C for at least 60 days of the year.

Maximum Temperatures

4.7 The efficiency and safety of the following EO are affected by storage at high temperatures and they are, when possible, not to be stored in storehouses in which the temperature can be expected to rise above the limits shown for a period longer than seven days:

a. 38º C:

(1) Fuze safety and stores containing fuze safety;

(2) Stores containing phosphorus, 5 in WP, 4.5 in Smoke, 81 mm mortar;

(3) TNT based explosives, 5 in HE, Demolition HE, Mk11 Depth Charge;

(4) Non–TNT based HE filled projectiles; and

(5) Triple base propellant, 4.5 in.

b. 32º C:

(1) Single base propellant – 5 in, 76 mm, 40/60, 20 mm, SAA;

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[1] In due course temperature limits for specific items will also be specified in Topic -026 of the item publication.

(2) Double base propellant shotgun ammunition, 81 mm Mortar propelling charge;

(3) Fuzes and fuzed rounds;

(4) Detonators and stores containing detonators not filled with lead azide; and

(5) 70 mm (2.75”) rockets.

Recording and Reporting of Guided Missile Temperatures

4.8 **Storage Temperature Limits.** The temperature extremes that should not be exceeded for guided missile motors are provided in each weapon’s handbook. If the stated temperature limits are likely to be exceeded, steps are to be taken to improve the temperature conditions.

4.9 **Recording and Reporting of Excessive Temperatures.** Missile storehouse temperatures are to be recorded daily when temperatures are likely to reach the prescribed limits. If these temperatures are reached or exceeded, a message report is to be made to the relevant Product Item Manager.

4.10 The provisions of paragraph 4.9 apply to all guided missiles and torpedoes.

Application of Data Loggers

4.11 Automatic Data Loggers (ADL) are used to record the climatic conditions under which EO has been stored as an aid to later determination of the need for testing and sentencing.

4.12 Product Item Managers should seek to have EO (or its transit packs) that is:

a. Adversely affected either chemically or physically by extremes of temperature, and

b. Likely to be employed in areas of extreme climatic conditions, fitted with ADL[2].

4.13 A decision to fit ADL to specific natures is not to be taken until:

a. The methodology for utilising the data provided by ADL has been determined, and

b. A cost benefit study for the particular nature establishes a financial advantage in utilising ADL.

4.14 The specific type of ADL for use in the explosives environment is to be authorised by the applicable Chief Engineer at the either Guided Weapons or Munitions Branch.

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[2] Electronic environment monitoring equipment such as data loggers is acceptable within any Category of EO area or building provided it is compliant with the general and detailed requirements of the enclosure standard required by the facility in which they are to be installed. It must also be subjected to an Electromagnetic Compatibility assessment prior to being cleared for use. Environment monitoring equipment is normally designed to log data across the 'Manufacture to Target' sequence and will require occasional maintenance and 'download' of data. These processes may not be compatible with the benign storage environment and normally must be preformed within an EO process facility. The Director of Explosive Ordnance Services may authorise the 'downloading' of data in he storage environment if a comprehensive risk assessment deems the activity tolerably safe.

PROCEDURE 5 - ENVIRONMENTAL CONTROL OF EXPLOSIVE ORDNANCE FACILITIES

Introduction

5.1 Some Explosive Ordnance (EO) will readily absorb moisture from the atmosphere and some may deteriorate in extremes of temperature. Packages and the protective coating on the packages or on the stores themselves can be adversely affected also if constantly in direct contact with water or continuously exposed to a moist atmosphere. It is important, therefore, that the interior of EO buildings is kept as dry and as temperate as practicable. Ventilation assists in this environmental control, but, in some instances, EO workshops and storage buildings may require climate control to maintain an acceptable environment. Details regarding the limits of temperature for certain EO are given in Regulation 4.1 Procedure 4.

Purpose

5.2 This procedure prescribes the environmental control measures to be adopted within EO storehouses, magazines and workshops so as to safeguard and prolong the life of EO.

GENERAL CONSIDERATIONS

General

5.3 Despite the importance of ventilation the indiscriminate admission of air into certain EO buildings may do more harm than good. In general, the sealing and the protective coating of the stores themselves, or of the packages in which they are contained, does much to offset the effects of moisture-laden air.

5.4 In continuously hot and humid climates, additional precautions may be necessary and the rules for the ventilation of EO workshops, given in paragraph 5.9 below, may need to be applied to all buildings containing EO. In hot and dry climates, it may be necessary to ventilate the buildings during the hours of darkness in order to cool them.

5.5 The higher the temperature of air the more moisture it requires to become saturated, therefore, it must not be concluded that on a warm day the air is necessarily drier and better for ventilation than on a cold day; the reverse may be the fact. Thus, in climates where the relative humidity is generally high, buildings in which EO are exposed are not to be opened for ventilation without first ascertaining that the conditions are suitable (see paragraphs 5.10 to 5.13 inclusive).

5.6 The ventilation of a previously closed building in which the internal temperature is lower than that of the incoming air may result in condensation both on the walls of the building and the stores therein. With a free flow of air, this moisture normally evaporates during the period of ventilation, but when the air flow is restricted, as may occur when the building is surrounded by high traverses or situated in a deep hollow, the rate of evaporation may be slow and several ventilation periods may be necessary before the moisture finally disappears.

5.7 Water which enters buildings through structural defects is to be distinguished from that resulting from condensation and its presence is to be reported upon and attended to without delay.

5.8 When suitable storage or working temperatures cannot be established by any other means, it may be necessary to resort to artificial heating or cooling. Artificial drying of the air may also be necessary for EO workshops in climates where the relative humidity is extremely high.

Climate Control

5.9 Where climate control plant or temperature control is installed, set conditions of temperature and humidity can be established, and therefore ventilation procedures set out in this instruction are not required. Any climate and temperature control plant installed in EO facilities is to meet the appropriate electrical standards for the facilities concerned.

EXPLOSIVE ORDNANCE STOREHOUSES AND MAGAZINES

General

5.10 During wet weather, doors of aboveground buildings are to be opened as infrequently as possible and then only for as long as is really necessary.

5.11 Each building is to be visited not less than once every month and, in addition, as soon as possible after a spell of very wet weather. On these occasions, a thorough examination is to be made and all instances of dampness of the building or contents are to be recorded for remedial action in accordance with local procedures.

5.12 Where such dampness is due to structural defects repairs are to be effected as soon as possible.

5.13 In extreme instances where persistent dampness is liable to have a harmful effect on the stores, before repairs can be done, other suitable and appropriate accommodation on the establishment is to be used, otherwise action is to be taken to have the stores temporarily and correctly stored elsewhere.

5.14 **Maximum and Minimum Thermometers.** Generally there is no requirement to record daily temperatures in EO storage facilities at Defence establishments in continental Australia as most items of EO are able to withstand temperature variations from at least -10º C to +40º C without adverse effect. However, if the ambient temperature is outside the above range for more than 72 hours, the appropriate Product Line Manager at the Guided Weapons or Munitions Branch is to be advised of the temperature range, the time period the temperature was experienced and the natures of EO involved. Certain items of EO are susceptible to temperature extremes and are therefore, to be stored in a controlled environment. Regulation 4.1 Procedure 4 provides guidance on the special storage conditions required for susceptible items of EO. Where the environment is required to be controlled, each EO storehouse (or one of a group of storehouses), is to be provided with a maximum/minimum thermometer, the readings of which are to be recorded at a set hour each working day. The indices of the thermometer are to be reset after each reading.

5.15 **Standardisation.** Before a thermometer is taken into use, and once each twelve months thereafter, the thermometer is to be calibrated against a standard thermometer and any difference in the readings is to be recorded on a label. The label is to be attached to the thermometer and the correction is to be applied to every subsequent reading of the thermometer.

5.16 Thermographs or similar temperature recording equipment may be used instead of max/min thermometers. The graphs are to be retained by the building supervisor.

EXPLOSIVE ORDNANCE WORKSHOPS

General

5.17 The ventilation of EO workshops will depend to a great extent on the nature of the EO being worked upon and the type of operations being done. For some workshop operations, free ventilation, is permitted, while for others the ventilation is to be controlled to assist in maintaining the correct internal hygrometric conditions.

5.18 EO workshops operations are divided into the four classes detailed below. Inspection and maintenance instructions are to indicate the required class of EO workshop for each explosive store:

a. Class 1. Clean conditions with restricted humidity.

b. Class 2. Restricted humidity.

c. Class 3. Clean conditions.

d. Class 4. No special requirements, but see Regulation 4.4 Procedure 3.

Ventilation of Explosive Ordnance Workshops for Class 1 or Class 2 Operations.

5.19 Class 1 or Class 2 operations require an atmospheric condition which will not give rise to moisture pick-up by the EO involved, thus both the actual relative humidity or the air inside the building and its temperature are deciding factors in regard to the opening or closing of doors and windows. The method of determining whether or not the conditions are suitable for work to proceed is detailed in Regulation 4.1 Procedure 6, and a constant watch is to be kept on the hygrometers to ensure that the correct conditions prevail at all times. If the outside air contains more moisture than the air within the building, the opening of doors and windows may be detrimental, while on the other hand, the admission of dry air into a wet atmosphere is obviously advantageous.

Ventilation of Explosive Ordnance Workshops for Class 3 and Class 4 Operations

5.20 The requirement of paragraph 5.10 is applicable to workshops in which Class 3 or Class 4 operations are done provided wetting from the atmosphere is avoided, eg condensation brought about by bringing cold stores into a warm room. Should wetting from the atmosphere occur, work is not to proceed until the condensation disappears. In certain climates, or at certain times of the year, it may be desirable for stores to be kept overnight in the workshop so that they will reach the ambient temperature before work commences.

PROCEDURE 6 - RESTRICTED HUMIDITY CONDITIONS

Introduction

6.1 Restricted humidity conditions are those required in Explosive Ordnance (EO) workshops where inspection or work is being performed involving the exposure of hygroscopic explosive substances and materials. Such conditions refer to the control of the relative humidity (RH) of the atmosphere which, for the purpose of these instructions, is based on a standard of 80 per cent RH at an air temperature of 16ºC.

Purpose

6.2 This procedure describes the equipment and details the procedure for determining relative humidity in EO facilities in which restricted humidity conditions are essential.

Relative Humidity

6.3 Relative humidity within the range of temperatures liable to be encountered in EO workshops may be defined as the ratio, expressed as a percentage, of the moisture that is present in air at a given temperature to the maximum amount that the air could hold at the same temperature without deposition occurring.

6.4 The moisture carrying capacity of air increases as its temperature rises, and conversely, decreases as the temperature falls. Should the air temperature fall without a corresponding decrease in the amount of water vapour present, the RH will rise until it reaches 100 per cent at the 'Dew Point'. Further reduction in temperature will cause water to be deposited, eg air having an RH of 80 per cent at 27ºC will, if it's actual moisture content remains unchanged, have an RH of 100 per cent when its temperature is reduced to 23.3ºC and will deposit water in increasing proportions as its temperature is further reduced. Water deposited under these conditions will form as condensation on any available surfaces.

6.5 The moisture present in the air may be absorbed by hygroscopic materials, the amount of water vapour available being greater, of course, at higher temperatures and relative humidity; therefore, in EO workshops where the control of humidity is required, it is essential to determine whether or not the conditions are favourable before work commences and throughout the working day. Specific requirements are detailed in relevant maintenance instructions.

Hygrometers

6.6 To determine whether working conditions are favourable, a Wet and Dry Hygrometer (eg Zeal or Brannan) is to be used. A Wet and Dry Hygrometer comprises two independent thermometers calibrated in degrees Celsius, the bulb of one of the thermometers being cooled by a wet muslin cylindrical wick, the lower portion of which is immersed in a reservoir of distilled water. The cooling of the wet bulb is dependent on the rate of evaporation of the water that increases as the temperature rises or the RH falls. The RH is determined by the temperature difference in conjunction with the dry bulb temperature. Annex A shows the variation of relative humidity with the dry bulb temperature and the wet bulb depression.

Use of Hygrometers

6.7 The hygrometer is to be installed away from direct sunlight, other radiation, draughts, upwards currents of air from radiators, etc, and in such a position in relation to the size and to the heating and ventilation arrangements of the building, that the humidity throughout will be correctly indicated. Ideally the hygrometer should be hung in a position where a steady flow of air around the bulbs is achieved.

6.8 The sequence of operations when using the hygrometer, ie when maintenance instructions require specific RH conditions, is:

a. Fan both bulbs gently for a period of 30 seconds.

b. Note the reading of the dry bulb.

c. Note the reading of the wet bulb.

d. Deduct the reading of the wet bulb from the reading of the dry bulb and note the difference.

e. Work may only proceed when the difference is equal to, or greater than, that given below against the relevant temperature range, otherwise work is not to be permitted until the conditions are satisfactory:

Temperature Range (Dry Bulb Reading) ºC	**Minimum Difference Between Wet and Dry Bulbs ºC**
0.0 – 7.0	1.5
7.5 – 15.0	2.0
15.5 – 23.0	2.5
23.5 – 32.0	3.0
32.5 – 40.0	3.5

NOTE

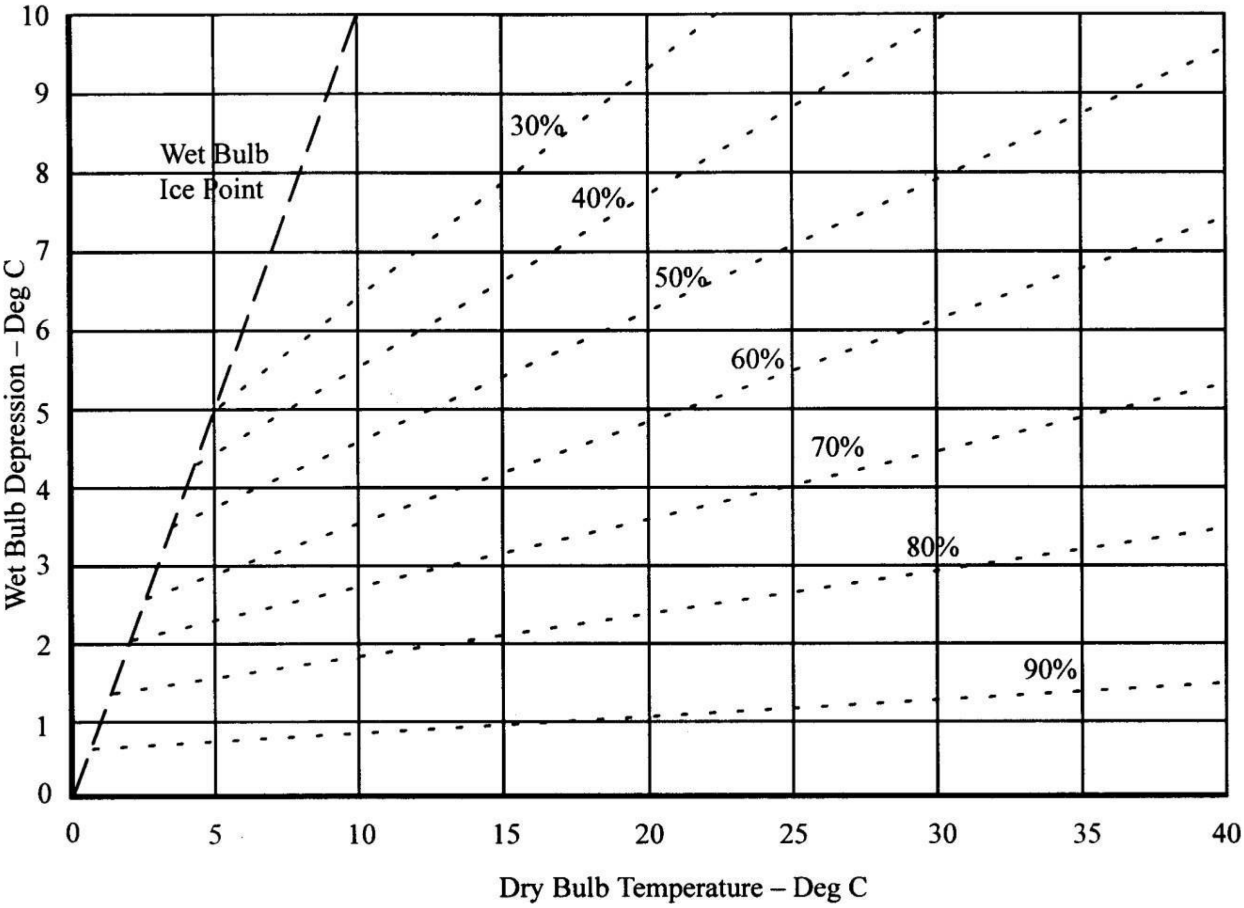
Due to the lack of an Australian Standard the above figures have been based on BS1339 and BS4833.

6.9 Instructions for the maintenance of hygrometers are given in Annex B.

Annexes:
A. Variation of Relative Humidity with the Dry Bulb Temperature and Wet Bulb Depression
B. Maintenance of Hygrometers

ANNEX A

VARIATION OF RELATIVE HUMIDITY WITH THE DRY BULB TEMPERATURE AND WET BULB DEPRESSION



ANNEX B

MAINTENANCE OF HYGROMETERS

1. To secure an accurate value of the temperature of evaporation, it is necessary to ensure that the accuracy of the reading is not affected by the presence of impurities in the water or by any reduction in the continuous supply of water to the moist fabric. In order to achieve this, the following maintenance instructions are to be complied with:

a. **Testing.** The hygrometer is to be submitted to a qualified testing authority every six months (see Note) for maintenance and testing. This will include comparing the thermometers against a master thermometer complying with the accuracy requirements for ordinary meteorological thermometers (Specification AS2819-1985), replacing the wick and cleaning the water reservoir.

NOTE

The testing authority may vary the period of testing and maintenance based on local conditions and instrumental history.

b. **Wick.** The muslin wick is to be free from grease, dirt or other contaminants and is to completely cover the bulb of the wet bulb thermometer. The wick is to be well immersed (about five centimetres) in the water reservoir and is always to be wet. Should the wick become visibly contaminated, the hygrometer is to be returned to the testing authority for maintenance.

c. **Water Reservoir.** The reservoir is to be clean and free from contaminants and topped up daily (or more frequently in hot dry conditions) with distilled water to ensure it is kept well filled. Should the water or reservoir become visibly contaminated, the reservoir is to be emptied, cleaned and refilled using only distilled water. The hygrometer is not to be read for fifteen minutes after the reservoir has been cleaned and refilled.

d. **Distilled Water.** Only distilled water is to be used in the reservoir. Containers of distilled water being used for daily top up of reservoirs are not to be used for any other purpose due to the possibility of contamination, eg possibility of electrolyte contamination if the container is used to top up lead acid car or forklift truck batteries.

PROCEDURE 7 - HANDLING OF PACKAGED EXPLOSIVE ORDNANCE

These procedures were formerly contained in DEOP 103, Part 3, Section 3, Chapter 3. In subsequent amendments to this publication this reference will be removed.

Purpose

7.1 This procedure prescribes the conditions applicable to, and the precautions to be observed when handling Explosive Ordnance (EO) either individually packaged or palletised.

General Precautions

7.2 All EO and EO packages are to be handled with care at all times. Rough handling may lead to damage to the package and contents, with subsequent reduction in safety, or the obliteration of markings, which may render the EO unserviceable. In particular:

a. When packages are moved they are to be lifted, not slid, rolled or dropped.

b. When one package is being stacked on another it is to be placed flat and not on one end, side or corner first.

c. When packages are being moved along a gravity conveyor roller, they are not to be allowed to collide with each other, nor are they to be propelled carelessly or violently.

d. When handling projectiles, either packaged or unpackaged, the utmost care is to be exercised to ensure that driving bands and fuzes are not damaged or distorted etc. The forward end of one projectile should not be allowed to collide with the base of another.

e. Any EO damaged during handling is to be set aside in accordance with local instructions for priority examination by appropriately qualified inspection staff familiar with the nature of the EO in question.

7.3 It cannot be too strongly emphasised that all persons are to exercise the greatest possible care in the handling of all EO. This rule applies not only to personnel employed in EO areas, but also to those engaged in the transportation of EO (see Regulation 3.1 Procedure 1). In no instance should safety be sacrificed in the interest of speed.

7.4 Some articles and substances, such as exposed explosives and pyrotechnic substances, may have additional hazards associated with the item, such as toxic effects. Items of these types will require special handling precautions to be observed. The relevant item publication or Item Manager will be able to specify the specific requirements to be observed to protect personnel from the additional hazards.

7.5 EO is not to be stripped, made inert, sectionalised or otherwise altered or interfered with, unless authorised in accordance with Regulation 2.4 or for the purpose of defect investigation or proof, and then only in accordance with authorised bench level instructions.

Mechanical Handling Equipment

7.6 Only mechanically and electrically operated materials handling equipment which conform to the constructional specifications and limitations prescribed in following Chapters are permitted in EO areas.

a. Regulation 4.6 Procedure 2.

b. Regulation 6.3 Procedure 1.

c. Regulation 6.3 Procedure 3.

Pallet Handling

7.7 The following conditions are applicable when palletising and stacking palletised EO and EO packages:

a. Palletising may be adopted for EO of Compatibility Groups B, C, D, E, F, G, N and S (see paragraph 7.8 for Compatibility Group H).

b. Pallets may be of any material suitable for use with the above groups, except that where the pallet forms part of a unit load, only the pallet specified in the Unit Load Specification is to be used.

c. Care is to be taken to ensure that packages and their contents are not damaged by over tensioning of strapping during palletising operations.

d. Packages may overhang the pallet provided they are stable in the unstrapped condition – see Regulation 4.1 Procedure 10. Whenever possible packages on the pallet are to be arranged to obtain a bonded stack.

e. The stacking heights are not to exceed those specified in Regulation 4.1 Procedure 8.

7.8 **Palletising of Compatibility Group H Explosive Ordnance.** EO which is classified in Compatibility Group H may be palletised, subject to the limitations in Regulation 4.1 Procedure 8.

General

7.9 A list of Dos and Don'ts in relation to handling of EO is provided at Annex A.

Annex:
A. DOs and DON'Ts when Handling EO

ANNEX A

DOS AND DON'TS WHEN HANDLING EO

General

1. Always remember that accidents can occur anywhere. It is a basic part of safety philosophy that ‘Accidents don’t just happen - they are caused’.

2. Personal injury may occur anywhere and at any time, but explosion of, or damage to stores, is most likely to occur during handling or movement. Therefore, you must exercise care at all times for your own and other people’s protection. Too much emphasis cannot be placed on the need for strict observance of the rules relating to the handling of stores by cranes, fork-lift trucks and the like.

3. To help remember some of the more important rules when handling EO they have been listed as a series of Dos and Don’ts. Make a point of reading through them to jog your memory.

DO

DO ensure explosives are ALWAYS carried, lifted and lowered with the utmost care.

DO see that loads are lifted and lowered slowly and gently. Use padding where required to protect delicate items from landing shocks.

DO learn the correct methods of slinging and handling.

DO see that the working area is clear of obstacles and that personal protective equipment (safety helmets, gloves, goggles etc) is worn.

DO see that someone who understands crane signals is in active control of all lifting operations and that personnel do not stand under loads.

DO use commonsense when slinging packages, etc, use all the lifting rings provided and make sure each load is safe before lifting. See that lids of packages are uppermost.

DO use only the authorised equipment for lifting loaded pallets and specialised containers.

DO examine steel strapping for security before lifting pallet loads.

DO check lifting gear before use for general condition and evidence of satisfactory testing.

DO ensure that slings have an adequate safe working load for the weight involved. **DO** use slings of sufficient length to give the smallest possible angle between legs. **DO** obtain even load distribution by using all legs in a multi-legged sling.

DO use slings with a much higher Safe Working Load (SWL) (at least twice the weight of the item being lifted) when handling items with an un-even weight distribution, ie the item is heavier at one end than the other.

DO pad sharp edges of loads to prevent damage and/or cutting of slings.

DO use steadying lines for long awkward loads.

DO use safety latches or safety crane hooks to prevent slings jumping off.

DO keep your back straight and take a good firm grip when lifting anything manually.

DO lift manually only within your physical capacity.

DO report immediately if any EO is dropped or involved in an accident. Request its examination by appropriately qualified personnel before further handling.

DO be extra careful when handling DETONATORS; they are sensitive to shock or friction. Packages MUST be passed by hand.

ANNEX A

DON'T

DON'T handle EO roughly or carelessly.

DON'T allow stores to be jolted, bumped or landed on a hard surface - they may be severely damaged.

DON'T take risks. If you are not sure of the correct method of lifting ask your supervisor for guidance.

DON'T risk accidents or injury through untidiness or failure to use personal protective equipment.

DON'T give any signals to the crane driver to lift or lower, unless it is your job, in which case make sure it is safe to do so.

DON'T sling stores in such a manner that they may break adrift in mid air.

DON'T strain lifting eyes by failing to use all of them.

DON'T sling packages by their handles.

DON'T improvise or use equipment other than that authorised, as this can lead to disaster.

DON'T lift pallets if you are in doubt about their safety and security - seek advice from your supervisor.

DON'T use lifting gear that is not in good condition or has not been tested as required by local instructions.

DON'T strain slings by exceeding the Safe Working Load.

DON'T use short slings that result in large angles between sling legs. (The larger the angle the greater the strain in each leg.)

DON'T strain individual legs by using them to take more than their share of the load, eg in a four legged sling with a Safe Working Load of 1 000 kg each leg can carry 250 kg.

DON'T risk an accident by using a limited number of sling legs to take the major share of the load.

DON'T take the chance of a sling breaking and allowing its load to fall.

DON'T allow loads to swing 'wild' - they may become uncontrollable.

DON'T risk losing a load by using an open hook.

DON'T risk severe back injury or damage to package or contents.

DON'T get hernia by straining - get help instead.

DON'T disturb items that have been dropped or involved in an accident unless it is essential for relieving or preventing further personnel injury, or to prevent further damage to stores or equipment.

DON'T lift packages of DETONATORS using slings.

DON'T JOLT or DROP DETONATORS.

PROCEDURE 8 - STACKING OF PACKAGED EXPLOSIVE ORDNANCE

Introduction

8.1 The principle of stacking is designed to achieve efficiency in storage, accounting and handling, and as an aid to implementing safety instructions.

Purpose

8.2 This procedure prescribes criteria for the stacking of packaged and palletised EO and associated non-explosives in storage.

General

8.3 Firm level surfaces with floor strength adequate for the proposed load are a fundamental necessity for the storage of packaged or palletised items. If there is doubt about the permitted loading of floors in EO facilities, specialist advice is to be sought. Where appropriate, floor loading limit notices are to be displayed.

Method of Stacking

8.4 Packaged EO is to be stacked in such a manner as to permit free circulation of air around each package. Packages are to be stacked on battens of sufficient height to allow free flow of air beneath the stacks and to clear any flooding which may occur under normal wet weather conditions; these battens are to be additional to those forming an integral part of packages. Battens need not be used where pallet stacking is utilised. Battens are to be of a size and of durable material suitable to their intended use. However battens and other dunnage of brick, concrete or any material which may give rise to grit or other contaminants are not to be used.

8.5 A space is to be left between stacks and walls of the buildings and between each stack, sufficient to permit ease of checking. See Regulation 4.1 Procedure 1, paragraph 1.22a for further details. Stacks should be at least 1 metre from doorways to provide protection from direct sunlight, rain, etc when doors are open.

8.6 An unobstructed aisle is to be left between each line of stacks. Aisles are to be wide enough to permit easy extraction of single packages, or pallets when these are in use. See Regulation 4.1 Procedure 1, paragraph 1.20 to 1.22 for further details.

8.7 A minimum all round gap of 50 mm is to be maintained between each individual stack of pallets to allow the removal of pallets without fouling and provide for ventilation. However, this requirement is negated if Mechanical Handling Equipment (MHE) that is fitted with side shift functionality to avoid fouling on the pallets is used. Additionally where a pallet configuration provides adequate ventilation with 50 mm between the items on pallet then a 50 mm separation between the actual pallets is not required.

8.8 Pallets are not to be stacked more than four deep from a working aisle. Where the same Nature and Lot are stacked together, they may be stacked six deep from a working aisle. Where there is a working aisle on either side of a stack, pallets may be stacked nine deep.

8.9 **Segregation of Explosive Ordnance for Stacking.** Ideally, EO is to be stored in separate stacks within a storehouse so as to:

a. Achieve economy of effort in the issue of stock;

b. Facilitate the issue of the oldest stock first;

c. Prevent incorrect issue of stock, eg issue of out-of-life or unserviceable items as serviceable stock;

d. Segregate different natures of the same type of EO, eg separate storage of ball and blank small arms ammunition; and

e. Facilitate easy identification of stock affected by special instructions such as EO Reclassification Messages, Lifing Data Variation Messages and Stock Management Instructions.

This can be achieved by segregating EO into stacks based on stock identification numbers, eg NSN and ASN, lot or batch number and Condition Codes.

8.10 The basis for stacking notwithstanding, the requirement for stock to be held in at least two places (see Regulation 4.1 Procedure 1 paragraph 1.5) is to be observed.

8.11 If EO bearing the same stock number but bearing different lot numbers is stacked together, each lot is to be segregated within the stack according to filler, mark and lot number, except where residual small quantities of lot numbers have been consolidated into a single package(s). EO without lot numbers is to be allocated a local lot number in accordance with Regulation 1.5 Procedure 1. Oldest lots are to be the most accessible as these are normally issued first (see Regulation 4.1 Procedure 4). Explosive Ordnance Stack Records should be attached to each stack in accordance with the requirements of Regulation 4.8 Procedure 1.

8.12 Packages are to be stacked, as far as possible, so that identification markings can be seen without disturbing the stack.

8.13 Fraction boxes are to be placed in a conspicuous position and clearly marked'FRACTION'.

STACKING HEIGHTS

General

8.14 Stacking heights may vary to suit local conditions providing stack stability is not compromised and stacks do not exceed the limits given in the following paragraphs. Notwithstanding the heights specified, when the building or stack in which EO is stored is traversed and when the EO is of a hazard division requiring traversing, the EO is to be stacked no higher than 600 mm from the top of the traverse (see Regulation 6.1 Procedure 2).

Separation between Ceiling and Top Packages or Pallet

8.15 A minimum separation distance of 300 mm is to be maintained between the top packages or pallet and the ceiling of a building to allow adequate ventilation and access to and removal of top packages or pallets; except where metal trusses are used in the buildings construction, then 500 mm minimum separation distance is to apply,.Where a building structure has exposed trusses with a cavity between the trusses and the roof, the top of the pallets must not protrude higher than the trusses, i.e. into the truss space. As a general rule, the 300 mm distance should apply however; where this is not practicable the distance may be reduced but still allow safe removal of the topmost packages/pallets. For igloo designed buildings, the stacking height is to provide a minimum of 500 mm clearance from the top of the stack to the roof. Furthermore, the outer face of any explosives package and the inner face of any adjacent structural wall or metallic fittings must be separated by 500 mm.

Unpalletised Explosive Ordnance

8.16 Unpalletised EO packages are to be stacked no more than two packages wide. Bulk stacking of EO is not permitted. There are no constraints on the length of the stacks within the physical confines of the storehouse, provided inspection aisles are maintained around each stack. The maximum permitted stacking heights for individual package types are as follows:

a. **Rectangular Packages.** Rectangular metal or wooden packages are to be stacked on their bases to a height not exceeding 3.7 metres with the following exceptions:

(1) Packages containing Compatibility Group B (CG B) EO, eg detonators, are not to exceed 1.5 metres, and

(2) Packages containing Compatibility Group H (CG H) EO, eg EO filled white phosphorus – see paragraphs 8.34a. and 8.35a.

b. **Cylindrical Packages.** Cylinders are to be stacked on their sides in tiers with any reinforcing bands coinciding throughout the stack. The following tier heights are not to be exceeded:

(1) Cylinders under 25 kg in weight – 8 tiers, and

(2) Cylinders 25 kg to 45 kg in weight – 5 tiers.

In any case, the maximum stack height is not to exceed 3.7 metres.

c. **Unboxed Shell.** Unboxed shells are to be stacked on their sides in tiers. The following tier heights are not to be exceeded:

(1) Up to 140 mm – 15 tiers,

(2) 140 mm to 175 mm – 11 tiers,

(3) 175 mm to 300 mm – 8 tiers, and

(4) Over 300 mm – 5 tiers.

8.17 Stability of Stacks. All stacks are to be stable, particular attention being paid to corners. Stability of the stack is to be achieved by one of the following methods:

a. **Bonding of Packages.** Packages of which the length is greater than the width are to be bonded.

b. **Use of Battens.** Battens are to be used to achieve stability and are to be positioned as follows:

(1) Metal packages – on the 3rd, 6th and 9th tiers.

(2) Wooden packages – between the 8th and 9th tiers.

(3) Cylindrical packages stacked vertically – between each tier.

(4) Packages approaching a cubical shape cannot be satisfactorily bonded and are therefore to be interspersed, layer by layer, with long wooden battens of regular thickness.

c. **Open Stacking.** The stability of a stack can be achieved by carefully adjusted open stacking, ie honeycombing. This method requires small symmetrical open spaces to be left between packages.

8.18 Stability of Unboxed Shell. Unboxed filled shell, except shell with either copper or steel base covers, are to be stored on their bases on wooden dunnage, except when racks or conveyors are installed, or where local conditions render it necessary to store them on their sides. When this is necessary, shells are to be arranged as follows:

a. The bottom tier is to be placed on wooden dunnage of sufficient thickness to prevent driving bands from coming in contact with the floor.

b. Tiers are to be arranged head to base to prevent damage to driving bands, but when this is not possible, battens are to be placed between tiers.

c. End shell in the bottom tier are to be secured by wooden scotches fixed to the dunnage, and when necessary, wooden wedges should be placed against the shoulders of all projectiles in the bottom tier to prevent movement.

d. Shell of calibre 175 mm and above are to be stacked with battens between tiers in order to protect driving bands and to facilitate handling.

8.19 Ventilation of Stacks. All stacks of EO are to be ventilated. This can be achieved when dunnage, battens or open stacking is used, and by the provision of gangways.

8.20 Restacking. Whenever restacking is necessary, the packages previously bearing the most weight should be repositioned to the top of the stack.

Palletised Explosive Ordnance

8.21 With due regard to the strength of the floor, stacking heights for loaded pallets are to be limited to:

a. 3.7 metres for pallets with battens on the underside which result in point loading of the contents of the lowest pallet, or

b. 5 metres for pallets with a base that distributes the weight evenly across the contents of the lower pallet, or

c. The height permitted by the stability of the stack when the pallets are fitted with supporting posts which take the weight instead of imposing it on the contents of the pallets below, or

d. Stacking heights detailed in paragraphs 8.34b. and 8.35b. for EO filled white phosphorus.

Metal Box Pallets (Cages)

8.22 The maximum stack height of box pallets is not to exceed four pallets.

Packaged Non-Explosives

8.23 A maximum stacking height of 5 metres is permitted for packaged non-explosives except for cylindrical tail units which are to be stacked as follows:

a. When stored vertically on their bases - not more than six tiers, and

b. When cradle stacked - not more than four tiers.

Use of Racks

8.24 The stacking heights given in paragraph 8.16 may be increased by the use of racks, but due regard is to be given to the strength of the floor and the additional risk involved should a package be dropped from the top of the stack. In any case, approval to stack in excess of the heights given in paragraph 8.16 must first be sought from the Explosive Ordnance Packaging Team in the Munitions Branch.

Self-Propulsive Missiles

8.25 Additional information on the stacking of self-propulsive missiles is contained in Regulation 6.1 Procedure 1.

Guided Weapons

8.26 For guided weapons, ie missiles and torpedoes, stacking heights and other handling criteria such as vehicle loading configurations, are usually identified in weapon specific manuals. This information is to be applied in preference to the non EO-specific criteria prescribed above.

EXPLOSIVE ORDNANCE CONTAINING PHOSPHORUS AND PHOSPHIDES (COMPATIBILITY GROUP H)

WARNING

PHOSPHORUS EXISTS IN TWO FORMS 'RED' AND 'WHITE'. THE RED FORM IS STABLE AND IS NOT SPONTANEOUSLY FLAMMABLE, BUT BURNT PARTICLES MAY TURN TO WHITE PHOSPHORUS AND LEAVE CRUSTED RESIDUE WHICH WILL SPONTANEOUSLY COMBUST WHEN DISTURBED. WHITE PHOSPHORUS (WHICH IS USED IN VARIOUS KINDS OF INCENDIARY AND SMOKE COMPOSITIONS) WHEN DRY, RAPIDLY OXIDISES IN AIR AND IGNITES SPONTANEOUSLY; IT FUMES WHILE OXIDISING. THE TENDENCY TO SPONTANEOUS IGNITION INCREASES WITH RISE IN TEMPERATURE. IT IS EASILY EXTINGUISHED BY WATER AND WHEN WET IS SAFE.

General Storage Requirements

8.27 EO containing phosphorus or phosphides, ie CG H EO, is to be stored in as cool a place as possible and is not to be exposed to the sun.

8.28 CG H EO is to be stored separately (segregated) from other types of EO.

8.29 Leakage of CG H EO is readily detected by a strong odour of the toxic gas phosphine. In the event of a leakage, the leaking store is to be immersed in water.

8.30 A good supply of water is to be kept available at or adjacent to, any building where CG H EO is held. Containers of water suitable for the immersion of the whole of the largest EO package are to be located inside each storehouse containing such stores to enable a 'leaker' to be immersed quickly if found.

NOTE

Ideally, the water container should be a wheeled plastic industrial waste bin. This allows for easy removal of the leaker from the EO storehouse.

EO storehouses containing EO filled with red phosphorus are to be ventilated at least weekly.

8.31 **Tools to Cut Banding.** Suitable tools to cut the banding of pallets are to be readily available in a prominent position in storehouses used to store CG H EO.

8.32 **Inspection for Leaking Stores.** Regular external inspection of each pallet or loose package of CG H EO is to be carried out at monthly intervals. Inspections are to be recorded.

Specific Storage and Stacking Requirements

8.33 **Design and Construction of CG H EO.** For storage purposes CG H EO is classified by its design and construction as thick or thin skinned[1] and specific storage and stacking conditions apply accordingly.

8.34 **Thick skinned CG H EO.** Natures of CG H EO such as gun and mortar ammunition are assessed as thick skinned and are to be stored as follows:

a. **Unpalletised.** Unpalletised packages are to be stacked as follows:

(1) To a height not exceeding 2 metres, and

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[1] Metal cased munitions are considered to be thin-skinned for the purpose of storage if their mean diameter to mean wall (excluding the base and/or fuze receptor wall) thickness ratio (D/t) is greater than 10 – see Glossary of Terms – Thin-skinned munitions.

(2) With ease of access to permit the prompt removal of any package showing signs of phosphorus leak.

b. **Palletised.** Palletised packages are to be stacked as follows:

(1) Up to three pallets high provided Manual Handling Equipment (MHE) is readily available,

NOTE

'MHE Readily Available' is defined as having MHE dedicated to that EO storehouse, and parked adjacent to the storehouse when not being utilised elsewhere in the EO area. The storehouse is always to have a working telephone. If the MHE is removed for service or repair, it is to be replaced until it returns.

(2) Each row of pallets to be no more than two pallets wide from an inspection or working aisle, and

(3) Ideally all pallets to be directly accessible by MHE however, in the worst case, the maximum number of pallets to be moved, in order to reach the least accessible pallet is not to exceed six.

8.35 **Thin skinned CG H EO.** Natures of CG H EO such as M34 Grenade and Rockets 2.75in, are assessed as thin skinned and are to be stored as follows:

a. **Unpalletised.** Unpalletised packages are to be stacked as follows:

(1) To a height not exceeding 1.5 metres, and

(2) With ease of access to permit the prompt removal of any package showing signs of phosphorus leak.

b. **Palletised.** Palletised packages are to be stacked as follows:

(1) Not in excess of one pallet high,

(2) Each row of pallets not more than two pallets wide from an inspection or working aisle, and

(3) With ease of access by either MHE or hand, to permit the prompt removal of any package showing signs of phosphorus leak.

Temperature Limitations

8.36 White Phosphorus (WP) liquefies if exposed to temperatures in excess of 44º C. To minimise hazards associated with the forming of cavities in WP filling (eg loss of ballistic performance, compression of filling on set back) EO filled WP is to be stored oriented to the following positions if the above temperature limitation is likely to be exceeded:

a. Grenades - fuze end upper most; and

b. Separate, fixed and semi-fixed ammunition natures and free flight rockets - nose end uppermost.

PROCEDURE 9 - STACKING OF UNPACKAGED EXPLOSIVE ORDNANCE

Purpose

9.1 This procedure prescribes criteria for, and precautions to be observed when, stacking unpackaged Explosive Ordnance (EO).

General

9.2 The procedures contained in Regulation 4.1 Procedure 8 paragraphs 8.4 to 8.12 are applicable also to unpackaged EO. Particular note is to be made of floor strength requirements.

Method of Storage - General

9.3 Providing the floor or ground is firm and reasonably level, unpackaged EO may be stored:

a. Vertically resting on transit bases, provided that adequate stability to the store is afforded; or

b. Horizontally, cradle-stacked in tiers, with the bottom tier secured with chocks and raised off the floor on suitable battens unless specific instructions are issued to the contrary.

Unpackaged Projectiles

9.4 If it is necessary to store projectiles loose and not in the approved packages as set out in Topic -025 of the item publication, the following method of stacking is to be employed:

a. The items are to be so arranged in stacks that no weight bears on driving bands.

b. The bottom tier is to be placed on wooden battens or pallets of sufficient thickness to prevent the driving bands coming in contact with the floor.

c. The end projectiles of each tier are to be secured by chocks fixed to the battens.

d. Battens are to be used between tiers to prevent damage to the driving bands.

9.5 Unboxed filled projectiles except projectiles with either copper or steel base covers, are to be stored on their bases on wooden dunnage, except where racks or conveyors are installed, or where local conditions render it necessary to store them on their sides.

Stacking Heights

9.6 Subject to the nature, strength and condition of the floor or the ground, and the stability of the stacks, unpackaged EO and non-explosive dangerous goods may be stacked to a maximum height of 3 metres except as follows:

a. High Capacity stores such as depth charges are normally to be stored in single tiers. When necessary, up to three tiers may be permitted but prior authority is to be obtained from the Explosive Ordnance Packaging Team in Munitions Branch.

b. Stacking height for loose projectiles is not to exceed 1 metre.

PROCEDURE 10 - RELATED NON-EXPLOSIVES - STORAGE AND INSPECTION

Introduction

10.1 There is a range of non-explosive items that are associated with Explosive Ordnance (EO). These items include drill, empty, instructional and inert filled EO, non-explosive components such as fuze adaptors, fuze covers, weapon arming components and consumable items such as paints, rubber, adhesives, felts etc.

10.2 Non-explosive Dangerous Goods (NEDG) are to be dealt with in accordance with Regulation 4.3 Procedure 1.

Purpose

10.3 This procedure prescribes the requirements for storage, inspection and transport of non-explosives associated with EO.

Terms and Definitions

10.4 For the purposes of this instruction non-explosives are grouped as follows:

a. **Inert Items.** Items which are in Service use and include inert filled, drill, dummy, servicing rounds, solid shot projectiles etc, and empty items that can be filled at a later date.

b. **Instructional Items.** Items which are used for training and display purposes, and include:

(1) Items of EO and NEDG which have been converted to non-explosive instructional items;

(2) Specifically manufactured items which have been made to represent an item of EO or NEDG;

(3) Sectionalised stores; and

(4) Inert items of EO and NEDG used for display purposes in museums or offices.

NOTE

An inert item may be referred to as an instructional item and vice versa, depending on the items current use, however the item will be marked 'inert' regardless of its use.

c. **Non-explosive Components.** Items such as projectile plugs, fuze adaptors and covers, tail units, fuzing wires and Guided Weapon (GW) components and sections that do not contain explosive substances.

d. **Consumable Items.** Items such as paints, sealants, adhesives, O-rings, felts, papers, nuts and bolts.

Storage

10.5 Inert and instructional items are not to be stored in an EO storehouse with 'live' EO of the same type. This is essential to prevent inadvertent mixing of filled and empty stores. Preferably, they are to be stored in a separate, dedicated, suitable non-explosives storehouse and afforded the same security and accounting requirements as live EO. Subject to security considerations this storehouse may be outside the EO area. Inert and instructional items on display are subject to security requirements of Annex C to Defence Security Manual (DSM) Part 2:67.

10.6 Whenever possible, inert items are to be stored under cover (see Regulation 4.1 Procedure 3).

10.7 Instructional items when in use are to be held under conditions which will prevent deterioration and so, prolong their useful life.

10.8 Non-explosive components may be stored in the same EO storehouse as their associated explosive items.

10.9 Normal general storage conditions apply to consumable items.

10.10 The packages containing inert, instructional items and non-explosive components are to be sealed in the manner prescribed for EO (see Regulation 2.3 Procedure 4).

Inspection

10.11 **Inert Items.** Inert items are to be submitted for inspection at intervals not exceeding five years. More frequent inspection may be necessary when directed or where storage conditions are unfavourable and deterioration is evident. Officers-in-Charge are responsible for submitting such items for inspection. EO storage depots are to include inert items in the depot's Routine Inspection program. Items need to be managed in accordance with the instructions provided by the Inerting organisation, and otherwise non-technically inspected annually (including legacy certified items) for evidence of degradation (e.g. discolouration, crystal growth etc.).

10.12 Inert items that are boxed may be inspected in the storehouse in which they are held provided no EO is present, or in any suitable building which does not contain EO, or in a compartment of an EO workshop in which there is no EO present.

10.13 **Instructional Items.** When instructional items are initially purchased or manufactured they are to be certified free from dangerous substances by an authorised inspector, marked with its new identification details and brought to account as required at Regulation 2.4.

10.14 All instructional items throughout Defence, including items held in offices and display cabinets, are to be submitted for inspection every five years. If there is any doubt on the condition of items, or there is any uncertainty as to the authenticity or date of their inert marking or certification, the holder is to immediately submit these items for inspection.

10.15 **Non-Explosive Components.** Non-explosive components are to be inspected as provided for inert items at paragraph 10.11, except that the inspection interval is to be triennial.

10.16 The provision of paragraph 10.15 does not apply to Guided Weapons (GW) components and sections for which separate policy will be detailed in appropriate GW documentation.

10.17 **Consumable Items.** Consumable items normally are not subject to inspection. When deterioration is evident, Officers-in-Charge are responsible for submitting such items for survey.

PROCEDURE 11 - INTER-SERVICE STORAGE OF EXPLOSIVE ORDNANCE

Introduction

11.1 From time to time there may be economic, operational or logistical reasons for having Explosive Ordnance (EO) of one Service stored in another Service's Establishment. Through this method of storage assistance more efficient use can be made of existing storage facilities and operational support can be better facilitated or any storage shortages that may exist can be alleviated.

Purpose

11.2 This instruction prescribes policy regarding the provision of storage of EO of one Service at another Service's Establishment.

11.3 Policy for the storage of EO at Defence Establishments for other Commonwealth Departments or State Government Departments, Foreign Services or commercial organisations, is defined in Regulation 4.1 Procedure 12.

Definition

11.4 The Service or Establishment that owns stocks held in storage by another Service will be described as the Owner Service or Establishment. The Service or Establishment storing EO on behalf of an Owner Service or Establishment will be described as the Holding Service or Establishment.

Policy

11.5 Storage facilities may be provided free of cost to other Services subject to the following requirements:

a. There is sufficient physical and explosives licence capacity at the proposed Holding Establishment.

b. The EO is stored at owner's risk.

c. The Officer-in-Charge of the Holding Establishment is authorised to destroy any item which is considered to be in a dangerous condition and further storage could jeopardise the safety of personnel, stock or property.

d. Any direct charges specifically incurred by the Holding Service in providing storage, mechanical handling equipment or manpower to meet such requirements are recoverable and are agreed between the Owner Service and the Holding Service.

e. EO is to be listed on the statutory accounts register on the Computer Support for Armament (COMSARM) Information Technology System to ensure explosives licensing and compatibility compliance, and that EO is not listed as surplus during mandatory Stocktake Programs. The Owner Service is to be entered on COMSARM. Where the Holding Establishment is not serviced by COMSARM, the EO holding is to be accounted for using the establishment's normal accounting system.

Application

11.6 All applications by one Service for storage assistance from another Service are initially to be negotiated locally between the Establishments concerned. A written application is then to be made by the requesting Establishment through its Command Headquarters to the Command Headquarters of the Establishment from which assistance is intended. Subsequent action is at the discretion of the Command Headquarters from which assistance has been requested however, the EO contracting authority within the Explosives Ordnance Branch is to be consulted early in the decision process.

11.7 All applications for assistance are to provide:

a. Details for each type of EO to be stored as follows:

(1) NATO Stock Number and Ammunition Serial Number;

(2) Service Item Name;

(3) UN Serial Number and Proper Shipping Name (see Regulation 2.1 Procedure 1);

(4) Hazard Classification Code;

(5) Quantity – number of item(s) and number and dimensions of packages/pallets; and

(6) Net Explosives Quantity.

b. The likely period of storage including anticipated turnover, ie whether or not stock will be static or if issues and returns are anticipated.

c. The authority for the Officer-in-Charge of the Holding Establishment to destroy any item which is considered to be in a dangerous condition and further storage could jeopardise the safety of personnel, stock or property.

Responsibilities of Owner Service or Establishment

11.8 The Owner Service will be responsible for the following:

a. Ensuring that the EO offered for storage is safe for storage, handling and transport, including movement under statutory requirements. This safety is to be vouched by a suitable certificate to be given to the Officer-in-Charge of the Holding Establishment by the Owner Service before the EO is handed over;

b. Advising the Officer-in-Charge of the Holding Establishment of any special characteristics or considerations affecting storage, handling and transport of the EO concerned, eg security classification, environmental control requirements and EO reclassification details;

c. Maintenance, inspection and stock control of its own stocks, unless by agreement, the Owner Service is prepared to delegate some or all these functions to the Holding Establishment. If any functions are delegated, a Memorandum of Agreement (MOA) is to be prepared locally to clearly define the division of responsibilities and channels of communication between Owner Establishment and Holding Establishment;

d. Issuing, annually, to the Officer-in-Charge of the Holding Establishment a suitable safety certificate to the effect that its stocks are safe for continued storage, handling and transport, when the Owner Establishment conducts maintenance and inspection of its own stocks; and

e. Providing competent personnel who may be attached to the Holding Establishment for discharging Owner Establishment responsibilities, as applicable.

Responsibilities of Holding Service or Establishment

11.9 The Holding Service will, in respect of Owner Service stocks, be responsible for the following:

a. Receiving, storing and issuing EO on behalf of the Owner Establishment;

b. Providing suitable storage, administration, non-technical labour, transport, access control and security arrangements;

c. Applying all safety instructions applicable to the Holding Establishment, together with any special requirements notified in accordance with paragraph 11.8b;

d. Undertaking such functions as are delegated by the Owner Establishment in accordance with the agreed MOA defining the divisions of responsibilities between Owner and Holding Establishments; and

e. Providing information to the Owner Establishment regarding his stocks through agreed channels of communication.

Memorandum of Agreement

11.10 Once approval to an application for assistance vide paragraph 11.6, has been given by the Command Headquarters of the Establishment concerned, any MOA deemed necessary under paragraph 11.8c should be drawn up, agreed, and published locally by the respective Services concerned, with information copies to each of the Command Headquarters.

11.11 If local agreement cannot be reached when drawing up the MOA, the circumstances are to be referred by both the Owner and Holding Establishments to the appropriate appointments in each of the Command Headquarters for advice and guidance.

11.12 Any alteration or modification to the division of responsibilities prescribed in paragraph 11.8 (except for paragraph 11.8c which is covered by action under paragraphs 11.10 and 11.11) and paragraph 11.9 required to meet local circumstances is to be recorded in a MOA. Details of any such alteration or modification are to be referred for approval to the appropriate appointments in each of the Command Headquarters concerned, before publication of the MOA.

Cost Recovery Arrangements

11.13 The Command Headquarters concerned are to ensure that if cost recovery pursuant to paragraph 11.5d is intended, the arrangements are agreed before approval is given to any application made in accordance with this instruction.

PROCEDURE 12 - STORAGE OF EXPLOSIVE ORDNANCE AT DEFENCE ESTABLISHMENTS FOR NON-DEFENCE ORGANISATIONS

Introduction

12.1 At times the Department of Defence may agree to store commercial and military type explosives (referred to as Explosive Ordnance (EO) in this instruction) belonging to other Commonwealth Government Departments, State Government Departments, Foreign Military Forces or commercial organisations.

Purpose

12.2 This instruction prescribes policy regarding the provision of storage of EO belonging to other Commonwealth Departments, State Government Departments, Foreign Military Forces or commercial organisations, in Defence facilities.

12.3 Policy for the storage of single Service owned EO at another single Service's storage facility is detailed in Procedure 11.

Scope

12.4 The requirements of this instruction would apply, for example, to requests for assistance to store EO belonging to the following organisations:

a. Commonwealth Departments such as Customs or CSIRO,

b. Civil Police Forces,

c. Visiting Foreign Military Forces such as the New Zealand Armed Forces,

d. Non-Government Organisations, and

e. Commercial companies such as Wesfarmers and Orica.

Definition

12.5 The authority that owns stock held on its behalf by a Defence Establishment, is to be known as the Owner Authority. The Defence facility storing on behalf of an Owner Authority, will be described as the Holding Establishment.

Policy

12.6 Storage facilities may be provided to Commonwealth or State Government departments, Foreign Military Forces or commercial organisations, subject to the following requirements:

a. There is sufficient physical and explosives licence capacity at the proposed Holding Establishment.

b. The EO can be safely stored in accordance with the requirements of this manual.

c. The EO is stored at owner's risk.

d. The Officer-in-Charge of the Holding Establishment is authorised to destroy any item which is considered to be in a dangerous condition and further storage could jeopardise the safety of personnel, stock or property.

e. Charges specifically incurred by the Holding Establishment in providing resources to meet such requirements should be recovered. Storage services can be provided to a commercial profit making entity at normal market rates provided those services cannot be provided by another commercial entity. Such charges are to be agreed between the Owner Authority and Defence through the Administrative Headquarters for the Holding Establishment.

f. EO is to be listed on the statutory accounts register on the Computer Support for Armament (COMSARM) IT System to ensure explosives licensing and compatibility compliance, and that EO is not listed as surplus during mandatory Stocktake Programs. The Owner Authority is to be entered on COMSARM. Where the Holding Establishment is not serviced by COMSARM, the EO holding is to be accounted for using the establishment's normal accounting system.

Requests for Assistance

12.7 Requests for storage assistance under the scope of this instruction are to be submitted in writing to the Administrative Headquarters of the establishment from which assistance is proposed. The Command Headquarters is to consult the EO Services Contract Authority at the Directorate of Explosive Ordnance Services (DEOS) before reaching a decision on the request.

12.8 All applications for assistance are to provide the following information, as a minimum:

a. Details for each type of EO to be stored, as follows:

(1) Item name;

(2) UN Serial Number and Proper Shipping Name;

(3) NATO Stock Number (NSN), if one exists;

(4) Hazard Classification Code;

(5) Quantity – number of item(s) and number and dimensions of packages/pallets; and

(6) Net Explosives Quantity.

b. The likely period of storage including anticipated turnover, ie whether or not stock will be static or if issues and returns are anticipated.

c. Whether or not transport or mechanical handling equipment owned by Defence or Defence EO Services Provider will be required.

d. The authority for the Officer-in-Charge of the Holding Establishment to destroy any item which is considered to be in a dangerous condition and further storage could jeopardise the safety of personnel, stock or property.

e. For other than Commonwealth Government departments or instrumentalities, a statement indemnifying the Commonwealth against loss or damage resulting from storage, handling and transport of the EO. Legal advice is then to be sought on the process for making the indemnity legally binding.

Responsibilities of Owner Authority

12.9 The Owner Authority will be responsible for the following:

a. Ensuring that the EO is safe for storage, handling and transport, including movement under statutory requirements. This safety is to be vouched by a suitable certificate to be given to the Officer-in-Charge of the Holding Establishment by the Owner Authority before the EO is handed over;

b. Advising the Officer-in-Charge of the Holding Establishment of any special characteristics or consideration affecting the storage, handling and transport of the EO concerned, eg security classification, environmental control requirements and safety or management related changes;

c. Maintenance, inspection and stock control of its stocks unless, by agreement, the Owner Authority is prepared to delegate some or all of these functions to Defence. A Memorandum of Agreement (MOA) or contract, or Implementing Arrangement for foreign government EO, as appropriate, is to be prepared to clearly define the division of responsibilities and channels of communication between the Owner Authority and Defence;

d. Provision of an annual safety certificate to the Officer-in-Charge of the Holding Establishment, advising that its stocks are safe for continued storage, handling and transport, when the Owner Authority conducts maintenance and inspection of its own stocks;

e. Providing competent personnel who may be attached to the Holding Establishment for discharging Owner Authority responsibilities as considered applicable; and

f. Providing the name and contact number of a competent person available on a 24 hour basis, in the case of an incident.

Responsibilities of Holding Establishment

12.10 The Holding Establishment will, in respect of owner stocks, be responsible for the following:

a. Receiving, storing and issuing EO on behalf of the Owner Authority;

b. Providing suitable storage, administration, non-technical labour, transport, access control and security arrangements;

c. Providing segregated storage for any explosives that are not listed in the Defence Explosive Ordnance Classification Listing;

d. Applying all safety requirements, together with any special requirements notified in paragraphs 12.8c and 12.9b;

e. Undertaking such functions as are requested by the Owner Authority in accordance with the agreed MOA or contract defining the divisions of responsibilities between the Owner Authority and Defence; and

f. Providing any information to the Owner Authority regarding the stocks through agreed channels of communication.

Memorandum of Agreement/Implementing Arrangement

12.11 Once approval to an application for assistance vide paragraph 12.7 has been given by the Administrative Headquarters, the MOA or contract required under paragraph 12.9c should be drawn up, agreed and endorsed by the Owner Authority and Defence.

12.12 For foreign government EO an Implementing Arrangement (IA) is to be drafted. Further guidance can be found in Defence Logistics Manual Part 2 Volume 8 Chapter 3 - *International Logistics Agreements and Arrangements* (DEFLOGMAN Part 2 Volume 8 Chapter 3).

Cost Recovery Arrangements

12.13 The Command Headquarters concerned is to ensure that cost recovery arrangements pursuant to paragraph 12.6e are agreed before approval is given to any application made in accordance with this instruction.

REGULATION 4.2 - MIXING RULES FOR STORAGE

General Overview

2.1 For practical needs in storage, it may be contemplated to mix Explosive Ordnance (EO) of different Hazard Divisions (HD) and different compatibility groups. The safety of EO would be ensured more easily if each kind was stored separately, but this ideal practice is not always practicable. A proper balance of the interest of safety against the other relevant factors must be observed.

2.2 These rules are based on the principles promulgated in AASTP-1 – Manual of NATO Safety Principles for the Storage of Military Ammunition and Explosives[1].

Requirements

2.3 All EO that is under control of Defence is to be stored in accordance with the following requirements of this regulation and its associated procedures.

Mixing Rules

2.4 **Mixed Storage – Principles.** EO of different HD and compatibility groups may be stored together if compatible. Additionally, EO may be mixed in storage as much as is necessary to promote operational efficiency. In particular:

a. The number of items requiring separate storage should not unduly interfere with the technical organisation and functioning of a facility or establishment in an operational role of issuing EO expeditiously in time of emergency with the minimum of personnel, handling equipment and transportation; and

b. The number of items requiring separate storage should be kept to a minimum in order to ensure that the area of land required and the costs of road and rail communications and of water supplies for firefighting will not be excessive.

2.5 **Mixing Rules - Hazard Divisions.** Mixed HD for above-ground storage are to be aggregated as given in Procedure 1.

2.6 **Mixing Rules - Compatibility Groups.** An overriding principle for the storage of EO is that different compatibility groups should be stored separately whenever possible. However, except at large depots and installations where there should normally be sufficient storage facilities/sites to provide separate storage, considerations of operational flexibility dictate a need for some degree of mixing of compatibility groups in storage. With the exception of substances in Compatibility Group A, which must not be mixed with other compatibility groups, the mixing of substances and articles is permitted as shown in Procedure 1.

2.7 **Special Circumstances.** Subject to technical advice and technical justification, the Director Ordnance Safety (DOS) may approve modification to the mixing rules for storage when considered appropriate in special circumstances. Such special circumstances are likely to occur when a small quantity of one HD is mixed with a large quantity of another HD, as follows:

a. **Very small quantity HD 1.1 and large quantity HD 1.2.** It should be possible to arrange storage in such a manner that the mixture will behave as HD 1.2.

b. **High weight ratio HD 1.3 to HD 1.5.** Generally, the fire risk will dominate, but under heavy confinement the risk of mass explosion dominates. Therefore, the greater Quantity Distance (QD) (HD 1.3 or HD 1.1) for the aggregate Net Explosives Quantity (NEQ) might be applied having taken into account the relative quantities of HD 1.3 and HD 1.5.

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[1] The continued use of AASTP 1: 2010 is under review

c. **Low weight ratio HD 1.3 to HD 1.5.** The risk of mass explosion is minimal and therefore the HD 1.3 QD for the aggregate NEQ might be applied having taken into account the relative quantities of HD 1.3 and HD 1.5.

2.8 **Suspect EO – Mixed Storage.** Suspect EO must not be stored with any other EO.

2.9 **Underground Storage.** The following limitations apply to underground storage:

a. **Ammunition containing Flammable Liquids or Gels.** Ammunition containing flammable liquids is only permitted in underground storage sites if proper protection against fuel leakage is established. The possible energy release of a stoichiometric combustion should be considered as part of the total energy release. Multi-chamber sites should be arranged and/or sealed in such a way that fuel-fire or gas explosion should not increase the likelihood of reaction in neighbouring chambers more than established through interior distances to prevent detonation transfer.

b. **Ammunition containing Toxic Agents.** Because of difficulties of decontamination underground, ammunition containing toxic agents should only be stored under special provisions.

c. **Suspect Ammunition and Explosives.** Suspect ammunition and explosives should not be stored.

d. **Ammunition containing Pyrotechnics.** Ammunition containing pyrotechnics, such as illuminating, smoke and signal ammunition, could in some cases be more vulnerable to mishaps or self ignition, and thereby increase the likelihood of an accident. The decision to store ammunition that contains pyrotechnics underground must be made on a site-specific basis and provisions must be taken to mitigate the peculiar hazards of pyrotechnic materials.

e. **Ammunition containing Depleted Uranium.** Before ammunition containing depleted uranium is permitted in underground sites, the slight radioactivity and chemical toxicity that would result from an accidental fire or explosion should be assessed and accepted.

Isolation of Explosive Ordnance

2.10 EO storage establishments are to provide an isolation facility. The facility is to be licensed for the storage of demolition kits and EO known to be or suspected of being unsafe pending its ultimate disposal. The isolation facility is to be sited such that damage resulting from an accidental explosion or fire is acceptable.

2.11 **Packaging.** All EO stored in an isolation facility is to be packed in approved containers/packages.

2.12 **Marking.** EO which is considered unsafe is to be placed in isolation.

2.13 **Recovered EO.** All EO recovered from EO disposal or incident tasking is to be clearly marked.

2.14 **Accounting Documentation.** Accounting documentation is not to be located within the isolation facility.

2.15 **Mixing of Isolated EO.** If the storage space is sufficient, EO requiring isolation should not be mixed in storage. However should storage space not be sufficient, isolated EO of different compatibility groups may be mixed under normal rules governing mixing.

Segregation of Explosive Ordnance

2.16 **Marking of Segregated EO.** All EO permitted to be segregated may be held in the same storehouse as serviceable stock provided each is held separately and positively identified.

2.17 **Mixing of Segregated EO.** The normal provisions for mixing compatibility groups and hazard divisions apply to EO requiring segregation (see paragraphs 2.5 – 2.6).

2.18 **Segregation of Ready-Use EO.** When EO is fuzed or otherwise 'made live' for use and is not required for immediate use, the EO or the packages in which it is contained are to be clearly marked to indicate its fuzed or 'made live' state. Such EO is to be segregated in ready-usestorage.

Responsibilities

2.19 Each element of Defence involved in the storage and handling of EO is to ensure compliance with this regulation and the associated procedures.

Procedures

2.20 Procedures used to implement the requirements of this regulation are:

a. Procedure 1 – Mixing of Compatibility Groups and Hazard Divisions for Above-Ground Storage

b. Procedure 2 – Isolation of Explosive Ordnance

c. Procedure 3 – Segregation of Explosive Ordnance

PROCEDURE 1 - MIXING OF COMPATIBILITY GROUPS AND HAZARD DIVISIONS FOR ABOVE-GROUND STORAGE

Purpose

1.1 This instruction prescribes the authorised mixing in storage of Explosive Ordnance (EO) of different compatibility groups and hazard divisions, of aggregate quantities in excess of 50 kg NEQ. The authorised mixing of 'small quantities' of EO is detailed in Regulation 5.3 Procedure 1.

Mixing of Hazard Divisions

1.2 The permitted quantities of EO that may be stored in an EO building vary with the hazard division of the EO in relation to the available quantity distances. To enable best use to be made of an EO building, mixing of hazard divisions within the authorised mixing of compatibility groups is permitted.

1.3 Details for determining the hazard division of mixed storage for EO of more than one hazard division in a single site are given in Annex A.

1.4 Details for determining the required quantity distance for EO of more than one hazard division in a single site are given in Regulation 5.4 Procedure 1.

1.5 Details for determining the permissible quantities of EO of more than one hazard division in a single site are given in Regulation 5.4 Procedure 1.

Mixing of Compatibility Groups in Storage for Explosive Articles

1.6 EO of different compatibility groups should normally be stored in separate EO storehouses. This instruction is to be especially observed at main EO storage depots where large quantities of EO may be at risk. However, the storage together of certain compatibility groups is now accepted as normal practice and is advantageous in that it eases the problems of planning new storage and enables stocks of each item are held in at least two buildings. The authorised mixing of groups for explosive articles is given in Annex B, and summarised in the chart in the Annex. The term 'building' in this context means the total area under one roof, whether or not divided into rooms or compartments or a number of buildings licensed as a group, or an equivalent underground chamber or area.

Mixing of Groups within Compartmented Buildings at User Establishments

1.7 Even at user establishments, the over-riding principle is always that EO of different compatibility groups should be stored in separate storehouses if at all possible. If this is not feasible, then mixing as authorised in Annex B is allowable. At user establishments only, a further relaxation, which should be exercised only to meet unforseen circumstances, is that EO may be mixed in each compartment or room of an EO storehouse in accordance with the provisions of Annex B. When such mixing takes place, EO is not to be positioned within 0.5 m of the inner walls of the compartments or rooms of the storehouse in which the EO is stored.

Mixing of Compatibility Groups in Storage for Explosive Substances

1.8 The compatibility of explosive substances in storage differs slightly from explosive articles. The authorised mixing of groups for explosive substances is given in Annex C, and summarised in the chart in the Annex.

Annexes:

A. Aboveground Storage - Mixing and Aggregation Rules for Hazard Divisions
B. Aboveground Storage - Authorised Mixing in Storage of Explosive Articles Compatibility Groups
C. Aboveground Storage - Authorised Mixing in Storage for Explosive Substances Compatibility Groups

ANNEX A

ABOVE-GROUND STORAGE - MIXING AND AGGREGATION RULES FOR HAZARD DIVISIONS

1. To enable best use to be made of explosive ordnance storage facilities, mixing of Hazard Divisions (HD) within the authorised mixing of Compatibility Groups is permitted. The HD of mixed storage of EO is to be determined from table 1A-1.

Hazard Division	**1.1**	**1.2.1**(2)	**1.2.2**(2)	**1.3**	**1.4**	**1.5**	**1.6**
1.1	1.1	1.1	1.1	1.1	1.1(3)	1.1	1.1
1.2.1(2)	1.1	1.2.1	1.2.1	1.1(4)	1.2.1(3)	1.1	1.1(5)
1.2.2(2)	1.1	1.2.1	1.2.2	1.1(4)	1.2.2(3)	1.1	1.1(5)
1.3	1.1	1.1(4)	1.1(4)	1.3	1.3(3)	1.1	1.1(5)
1.4	1.1(3)	1.2.1(3)	1.2.2(3)	1.3(3)	1.4	1.5(3)	1.6(3)
1.5	1.1	1.1	1.1	1.1	1.5(3)	1.5	1.1(5)
1.6	1.1	1.1(5)	1.1(5)	1.1(5)	1.6(3)	1.1(5)	1.1(5)

Table 1A–1: Aboveground Storage - Mixing and Aggregation Rules for Hazard Divisions (1)

Notes

(1) When more than two HD are present in storage, any two of those HD are to be considered in determining a resultant HD, which is then to be considered with the next HD and so on until all HD present in storage have been considered.

(2) HD Subdivisions are used for storage purposes only and are not a recognised code under the UN System. Refer to Regulation 5.4 for further explanation of Subdivisions.

(3) 1.4 may be stored with any other HD without aggregation.

(4) Mixed 1.2.1/1.2.2 and 1.3 will usually behave as aggregated 1.2 or 1.3 (see Regulation 5.4 Procedure 1). However, there is a significant risk that, in certain circumstances, a mix of 1.2 and 1.3 will behave as an aggregated quantity of 1.1. If any of the following circumstances exists the mix must be aggregated as 1.1, unless relevant trials or analyses indicate otherwise:

a. The presence of 1.2 shaped charges;

b. The presence of high energy propellants, eg as used in some tank gun applications;

c. The presence of 1.3 under conditions of heavy confinement; or

d. The presence of 1.2 articles with an individual NEQ > 5 kg.

(5) 1.1 unless demonstrated by testing or analogy to be otherwise.

ANNEX B

ABOVE-GROUND STORAGE - AUTHORISED MIXING IN STORAGE OF EXPLOSIVE ARTICLES COMPATIBILITY GROUPS

1. Subject to the observance of the provisions of paragraph 2, EO of various compatibility groups may be stored together as indicated in the Compatibility Group Mixing Chart and notes below. In all instances when mixing of Groups in the same building occurs, EO of different Groups is to be separated by the maximum distances possible.

2. The marking 'X' at an intersection of the chart indicates that those Groups may be combined in storage, that is:

a. Groups C, D, and E may be stored together.

b. Group S may be stored with any other Group except Groups A, K and L.

Other permitted combinations with certain restrictions are detailed in the Notes to the Mixing Chart, otherwise mixing is prohibited.

3. Special Circumstances. If special circumstances require mixing combinations other than those permitted by table 1B-1, subject to technical advice and technical justification, the Director Ordnance Safety (OS) may approve modification to mixing rules. For example, Compatibility Group F articles are normally to be segregated but they may be stored with other articles when the means are available to substantially reduce the risk of propagation from the Compatibility Group F articles. In considering such mixing the following points must be addressed:

a. Does a particular item, or its level of protection provided by its packaging, increase the probability of serious accident when mixed with other like items or compatibility groups? If so, is the magnitude of increase in probability acceptable?

b. What is the increase in the magnitude of the explosives effects if an accident occurs?

c. If the mixing is not approved, does the explosives hazard increase because of some other influence?

d. If approved, what action is to be taken to ensure the explosives hazard and its duration are minimised?

e. Are alternative levels of inside QD protection appropriate to balance the perceived increase in probability of an accident?

4. Suspect Explosive Ordnance. Suspect EO must not be stored with any other EO.

ANNEX B

CG	A	B	C	D	E	F	G	H	J	K	L	N	S(9)
A	X												
B		X(8)	(1,8)	(1,8)	(1,8)	(1,8)	(8)						X
C		(1,8)	X	X	X	(2)	(3)					(7)	X
D		(1,8)	X	X	X	(2)	(3)					(7)	X
E		(1,8)	X	X	X	(2)	(3)					(7)	X
F		(1,8)	(2)	(2)	(2)	X	(2,3)						X
G		(8)	(3)	(3)	(3)	(2,3)	X	(4)					X
H							(4)	X					X
J									X				X
K										X(5)			
L											(6)		
N			(7)	(7)	(7)							X	X
S(9)		X	X	X	X	X	X	X	X			X	X

Table 1B–1: Storage Compatibility Group Mixing Chart for Explosive Articles

Notes for the interpretation of compatibility group mixing chart

(X) Mixing Permitted.

(1) The following conditions are applicable to EO of Group B:

a. Detonators of Group B may be stored with EO of Groups C, D, E and F. The detonators, up to a total NEQ of 1.5 kg, must be stored in an approved package and must be segregated from the other Group(s) by a traverse of sufficient dimensions to screen all lines of sight (see Note 12), except that up to 0.2 kg NEQ of detonators may be stored in an approved package, without traversing, provided the detonators are stored at least 1m from any other EO.

b. EO of Group B (other than detonators) may be stored with EO of Groups C, D, E and F provided the EO of Group B is segregated from the other Groups by a traverse of sufficient dimensions to effectively screen all lines of sight to prevent instantaneous propagation. The total NEQ of Group B permitted for storage under these conditions can vary depending on the dimensions of the traverse (see Note 12 for details).

c. Fuzes of Group B may be stored with the articles to which they will be assembled, but the NEQ must be aggregated and the whole treated as Group F for further mixing purposes. See also Notes 10 and 11.

(2) EO of Group F may be stored with EO of Groups C, D, E and G provided the EO of Group F is segregated from the other Groups by a traverse of sufficient dimensions to effectively screen all lines of sight to prevent instantaneous propagation. The total NEQ of EO of Group F permitted for storage under these conditions can vary depending on the dimensions of the traverse (see Note 12 for details).

(3) The following conditions are applicable to EO of Group G:

a. EO of Group G that is not likely to give rise to loose powder may be stored with EO of Groups C, D, E and F.

ANNEX B

b. Substances of Groups C, D and G which do not give rise to loose powder and which are less sensitive to mechanical stimuli than dry RDX may be mixed in storage.

Items packed in accordance with packaging authorised in Topic - 025 of the item publication, will not give rise to loose powder.

(4) EO of Groups G and H may be stored in the same site but must be segregated by a floor-to-ceiling 230mm brick wall (or a wall of equivalent fire rating).

(5) EO of Group K requires separate storage from all other Groups and may also require separate storage within the Group.

(6) EO of Group L requires separate storage from all other Groups and also requires separate storage within the Group. However, the Licensing Authority may approve mixing of specified types of Group L where assessment of the hazards of each type shows this to be reasonable. For example, different types of missiles using the same combination of fuel and oxidant may be stored in the same building.

(7) EO of Group N may be stored with EO of Groups C, D and E. When so stored, EO of Group N is to be considered as having the characteristics of EO of Group D for further mixing purposes.

(8) EO of HD 1.4 Compatibility Groups B, C, D, E, F and G may be mixed in storage with EO of Groups B, C, D, E, F or G in other HD.

(9) EO of Group S and empty, inert filled, drill and instructional items of EO may be stored with EO or substances from any Group except Groups A, K and L. Empty, inert filled, etc items may be kept in a building with filled items but not those of similar types (see Regulation 4.1 Procedure 11).

(10) Equal numbers of fuzes and other components of complete rounds of ammunition may be stored in the same site as the ammunition to which they belong. When so stored, the Compatibility Group is that of the assembled round for further mixing purposes.

(11) Items of EO that are complete or incomplete, with or without explosives may be stored with related complete items of EO provided they are compatible. For example, projectiles containing white phosphorus, but without bursting charges, may be stored with white phosphorus projectiles containing explosives.

(12) For a given NEQ of EO of Group B and Group F, a traverse may be constructed of brick, reinforced concrete, steel, hardwood, or suitable containers packed with sand/earth. If a combination of materials is used, the traverse thickness may be calculated on the basis of the effectiveness of materials in stopping high velocity fragments compared with hardwood or packed sand or earth. For brick, reinforced concrete, or steel (compared with hardwood or packed sand/earth) the effectiveness can be taken as 4, 6 and 24 times respectively. In every case, EO is not to be placed within 0.5 m of the traverse and the traverse is to exceed the height of the stored EO by at least 600 mm. Traverse dimensions and construction are to accord with the requirements of Table 1B-2.

NEQ of EO of Groups B or F	**Thickness of Traverse of Brick/Reinforced Concrete at 3m centres, 0.2% tension reinforcement**	**Thickness of Traverse of hardwood or packed sand/earth**
Up to 5 kg	340 mm/225 mm	1350 mm
5 to 7 kg	450 mm/225 mm	1800 mm
7 to 12 kg	570 mm/225 mm	Not Permitted
12 to 18 kg	700 mm/300 mm	Not Permitted

Table 1B–2: Traverse Dimensions and Construction

This situation is intended only for the storage of small quantities of EO and for instances where it is uneconomical to provide a permanently compartmented building(s). For larger NEQ, where the building is, or may be internally traversed, see Regulation 6.1 Procedure 2.

ANNEX C

ABOVEGROUND STORAGE - AUTHORISED MIXING IN STORAGE FOR EXPLOSIVE SUBSTANCES COMPATIBILITY GROUPS

1. With the exception of substances in Compatibility Group A, which must not be mixed with other compatibility groups, the mixing of substances is permitted as indicated in the Compatibility Group Mixing Chart and notes below. In all instances when mixing of Groups in the same building occurs, EO of different Groups is to be separated by the maximum distances possible.

2. The marking 'X' at an intersection of the chart indicates that those Groups may be combined in storage. Other permitted combinations with certain restrictions are detailed in the Notes to the Mixing Chart, otherwise mixing is prohibited.

3. **Special Circumstances.** If special circumstances require mixing combinations other than those permitted by table 1C-1, subject to technical advice and technical justification, the Director Ordnance Safety (DOS) may approve modification to mixing rules. For example, Compatibility Group F articles are normally to be segregated but they may be stored with other articles when the means are available to substantially reduce the risk of propagation from the Compatibility Group F articles. In considering such mixing the following points must be addressed:

a. Does a particular item, or its level of protection provided by its packaging, increase the probability of serious accident when mixed with other like items or compatibility groups? If so, is the magnitude of increase in probability acceptable?

b. What is the increase in the magnitude of the explosives effects if an accident occurs?

c. If the mixing is not approved, does the explosives hazard increase because of some other influence?

d. If approved, what action is to be taken to ensure the explosives hazard and its duration are minimised?

e. Are alternative levels of inside QD protection appropriate to balance the perceived increase in probability of an accident?

4. **Suspect Explosive Ordnance.** Suspect EO must not be stored with any other EO.

Compatibility Group	**A**	**C**	**D**	**G**	**L**(2)	**S**(4)
A	X					
C		X(1)	X(1)	(3)		X
D		X(1)	X(1)	(3)		X
G		(3)	(3)	X		X
L(2)					(2)	
S(4)		X	X	X		X

Table 1C–1: Storage Compatibility Group Mixing Chart for Explosive Substances

Notes

(X) Mixing Permitted.

(1) Mixing permitted provided substances have all passed United Nations (UN) Test Series 3. Mixed storage of substances of any Compatibility C, D or G which has failed UN Test Series 3 will require special consideration by the DOS.

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(2) Compatibility Group L substances must always be stored separately from all substances of other compatibility groups as well as from all other substances of Compatibility Group L.

(3) The mixing of Compatibility Group G substances which do not give rise to loose powder and which are less sensitive to mechanical stimuli than dry cyclotrimethylenetrinitramine (RDX) my be mixed in storage with substances of Compatibility Groups C and D.

(4) Inert and substances of Compatibility Group S may be stored with substances of any compatibility groups except Compatibility Groups A and L.

PROCEDURE 2 - ISOLATION OF EXPLOSIVE ORDNANCE

Introduction

2.1 Explosive Ordnance (EO) storage establishments are to provide an 'isolation' facility. The facility is to be licensed for the storage of demolition kits and EO known to be or suspected of being unsafe pending its ultimate disposal. The isolation facility is to be sited such that damage resulting from an accidental explosion or fire is acceptable.

Purpose

2.2 This procedure prescribes the conditions whereby EO must be isolated (see definition in Glossary of Terms) from other EO in storage.

Explosive Ordnance to be Isolated

2.3 The following EO is always to be isolated:

a. Repairable or unserviceable EO which has been certified unsafe by inspection;

b. EO which the user or holder considers to have become unsafe;

c. EO suspected of being unsafe following a Service report;

d. Salvaged EO from an EOD task or after an accident, explosion, fire or trial;

e. Misfired EO that has been certified as safe for recovery; and

f. EO suspected of being tampered with or displaying damage.

2.4 EO earmarked for storage in isolation should be destroyed or otherwise disposed of as soon as practicable.

Packaging

2.5 All EO stored in an isolation facility is to be packed in an approved container/package.

Marking and Documentation

2.6 EO which is considered unsafe for normal storage is to be 'Black Listed' and placed in isolation pending urgent disposal action.

2.7 All EO recovered from EO disposal or an incident task is to be marked for identification. As a minimum, the Disposal or Incident Report Number is to be marked on each item.

2.8 Accounting documentation is not to be located within the isolation facility.

Mixing of Isolated Explosive Ordnance

2.9 If the storage space available is sufficient, EO requiring isolation should not be mixed in storage, ie individual items of EO or demolition kits, etc are to be separated by distance or a combination of distance and traversing, so as to reduce the probability of instantaneous propagation of an accidental explosion between items/kits. Otherwise EO of different compatibility groups may be mixed under the normal rules governing mixing.

PROCEDURE 3 - SEGREGATION OF EXPLOSIVE ORDNANCE

Purpose

3.1 This instruction prescribes the conditions whereby explosive Ordnance (EO) must be segregated (see definition in Glossary of Terms) from other EO during storage.

Explosive Ordnance to be segregated

3.2 The following EO is always to be segregated:

a. Returns or receipts which are damaged, or incorrectly packaged or sealed, but considered safe;

b. Returns from Ships;

c. Experimental EO; and

d. EO known to be or suspected of being other than serviceable but not unsafe.

Marking of Segregated Explosive Ordnance

3.3 All EO permitted to be segregated may be held in the same storehouse as serviceable stock provided each is held separately and positively identified.

Mixing of Segregated Explosive Ordnance

3.4 The normal provisions for mixing of groups and hazard divisions applies to EO requiring segregation.

Ready-Use Explosive Ordnance

3.5 When EO is fuzed or otherwise 'made live' for use in an emergency, or for practice purposes, or for any other reason, eg some types grenades or bombs/charges fitted with fuzes, and is not required for immediate use, the EO or the packages in which it is contained are to be clearly marked to indicate its fuzed or 'made live' state. Such EO is to be segregated in ready-usestorage.

REGULATION 4.3 - STORAGE OF NON-EXPLOSIVE DANGEROUS GOODS

General Overview

3.1 Dangerous goods which are not of Class 1—Explosives should not be stored in an Explosive Ordnance (EO) storage area because of the additional hazards which may be introduced by their presence in the vicinity of EO. For example, an additional hazard may result from a volatile liquid leaking into the area drainage system, or the presence of the Non-Explosives Dangerous Goods (NEDG) may involve the right of access to the area for non-qualified personnel who would not normally be permitted in the area.

Requirements

3.2 All storage of NEDG in explosive storage areas must be conducted in accordance this regulation and its associated procedures.

3.3 In special circumstances where storage of NEDG in, or in the vicinity of, the area is essential, such storage must be specially authorised by the facility licensing authority.

3.4 Further advice may be sought from the Explosives Storage and Transport Committee (ESTC) which will consider such matters as the compatibility of the types of dangerous goods involved, the effects of the methods of packaging of the hazardous material(s) and, the need to restrict stacking to a single tier.

3.5 **Weapons filled with NEDG.** Where weapons or their components filled with NEDG are stored in an explosives storage area, the weapons or components are normally, but not always treated as Hazard Division 1.3 EO for Quantity Distance (QD) purposes, see Regulation 5.4 Procedure 1.

3.6 The Defence Explosive Ordnance Classification Listing (DEOCL) contains equivalent hazard classification codes for some NEDG.

3.7 Weapons or their components filled with NEDG goods are classified in accordance with the United Nations (UN) publication *Recommendations on the Transport of Dangerous Goods—Model Regulations, ST/SG/AC.10/1 (as revised) (Orange Book)*.

3.8 **Bulk Storage.** When NEDG not related to weapons are stored in bulk, special separation distances will be laid down, based on the degree of structural protection afforded by the type of storage provided for the dangerous goods and related to the appropriate QDs for any EO contained in the area. With NEDG in surface storage sites, the special distance required is usually the inhabited building distances from sites containing EO. Where the structural protection of the NEDG warrants it, the licensing authority may determine a lesser distance subject to a minimum distance of 25 m. If underground storage sites are involved, the special distance is usually the inside QD from the site containing the EO with a minimum of 25 m.

3.9 **Storage of Small Quantities.** Small quantities of petroleum, oil and lubricants for operational purposes within a military installation require no specific separation distance from buildings or stacks containing EO. However, due regard must be taken of fire regulations.

Responsibilities

3.10 Each element of Defence involved in the storage of NEDG are to ensure compliance with this regulation and its associated procedure.

Procedures

3.11 The procedure for the implementation of this regulatory requirement is Procedure 1 – Non-Explosive Dangerous Goods – Storage and Inspection.

PROCEDURE 1 - NON-EXPLOSIVE DANGEROUS GOODS - STORAGE AND INSPECTION

Introduction

1.1 Explosive Ordnance (EO) storage areas are specifically designed for the storage of dangerous goods Class 1. Other classes of dangerous goods, especially when stored in bulk, normally should not be stored in those areas because of the additional hazards that may be introduced by their presence in the vicinity of EO. For example, an additional hazard may result from a volatile liquid leaking into the drainage system, or the presence of the dangerous goods may involve the right of access to the area for non-EO qualified personnel who would not normally be permitted in the area. Nonetheless, there are a number of stores or substances in the Defence inventory classified as dangerous goods in classes 2 to 9, that are related by function to EO and used for somewhat similar purposes as certain types of EO, or are components of weapon systems. These items or substances whether for convenience, security or other reasons are normally stored in EO storage areas. For the purpose of this manual these items and substances are referred to as Non-Explosive Dangerous Goods (NEDG).

1.2 NEDG are by their nature hazardous and whenever their storage within or in the vicinity of an EO storehouse is unavoidable, NEDG are to be managed as though they belong to Dangerous Goods Class 1. To this end, NEDG are assigned a pseudo Hazard Classification Code (HCC) for storage, handling and transportation purposes (see Annex A, Table 1A-1).

Purpose

1.3 This procedure prescribes the requirements for the storage, inspection and transportation of NEDG.

STORAGE

General

1.4 NEDG may be stored in an EO area at Quantity Distances (QD) appropriate to the assigned pseudo HCC.

1.5 NEDG normally are not to be stored in the same storehouse as EO. However, NEDG that are components of weapon systems may be stored in the same storehouse as the EO components of the parent weapon systems.

1.6 Other NEDG may be stored in the same storehouse provided they are held in a separate compartment of the storehouse and segregated in accordance with the requirements of the Hazardous Chemicals – Storage and Segregation Guide for Workplaces.

1.7 NEDG may be stored with EO for ready-use purposes in small quantity facilities located outside EO storage areas under the special conditions of storage addressed in Regulation 5.3 Procedure 1.

1.8 When dangerous goods are stored ‘in bulk’[1] in the vicinity of EO, special separation distances are prescribed based on the degree of structural protection afforded by the type of storage provided for the dangerous goods and related to the QD for the EO in question. With such dangerous goods in surface storage sites, the separation distance required is usually the Inhabited Building Distance from sites containing EO. Where the structural protection of the dangerous goods warrants it, the Licensing Authority may determine a lesser distance subject to a minimum distance of 25 m. If underground storage sites are involved, the separation distance is usually the Inside Quantity Distance from the site containing the EO with a minimum of 25 m. A summary of treatments for storage of some dangerous goods liquids in bulk is given in Annex A.

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[1] To store 'in bulk' means the storage of, or to store, dangerous goods in a receptacle other than a package.

1.9 Advice on the treatment of weapons or components of weapons filled with specified NEDG substances is given in Annex A. Further advice may be sought from the Explosives Storage and Transport Committee (ESTC) of the Directorate of Ordnance Safety (DOS). The ESTC will consider such matters as compatibility, methods of packaging and the need to restrict stacking heights.

Segregation

1.10 When NEDG of various dangerous goods classes are stored together in the same storehouse or compartment of a storehouse, they are to be separated from each other in accordance with the requirements of the Hazardous Chemicals – Storage and Segregation Guide for Workplaces.

Petrol Oils and Lubricants

1.11 The criteria in Annex A for the separation of Petrol, Oils and Lubricants (POL) storage sites from EO storage sites is further detailed in Regulation 5.4 Annex C.

Authorisation Requirements

1.12 Storehouses containing NEDG are to be authorised by the relevant Licensing Authority. The authorisation is to identify, as a minimum, the Dangerous Goods Classes and quantities that are permitted to be stored together with the conditions or limitations that apply to the particular site.

Application for Non – Explosive Dangerous Goods Facility Authorisation (Form EO 007)

1.13 The application process for new NEDG Authorisations is detailed in Regulation 5.2 Procedure 1.

Packaging and Marking Requirements

1.14 The authorised packages for NEDG are specified in the relevant Topic - 025 of the item publication. Packages of all NEDG are to be stencilled or labelled in accordance with the Defence standard DEF (AUST) 1000C. The pseudo HCC is not to be marked on packages for NEDG.

1.15 Packages containing NEDG that will give off spontaneously flammable gas when brought into contact with moisture are to carry an additional marking to show the substance the item contains - see specimen at Annex B.

Display of Fire Division Symbols and Supplementary Fire Symbols

1.16 **Stores which contain EO and NEDG.** Storehouses containing both EO and NEDG are to be signposted on each vehicular approach to the storehouse with the fire division symbol representing the most significant hazard for the EO stored, together with the applicable supplementary fire symbol(s) as provided for at paragraph 1.17.

1.17 **NEDG Only Storehouses.** Storehouses containing NEDG only are to be signposted on each vehicular approach to the storehouse with the EO fire division symbol signifying the greatest risk, together with the applicable supplementary fire symbol(s). Additionally, when NEDG are stored in compartments of a multi-compartmented storehouses the appropriate supplementary symbol(s) is to be displayed adjacent to the door of the relevant compartment, with the supplementary symbol(s) for the most significant hazard(s) displayed on the approaches to the storehouse. The supplementary symbol(s) is to be positioned so as not to be obscured when the door of the compartment is open. For additional information on supplementary symbols, refer to Regulation 4.7 Procedure 1 and its associated Annexes C and D.

INSPECTION

1.18 NEDG are to be subjected to inspection as for EO (see Regulation 1.5 Procedure 1).

1.19 Weapons or weapon components NEDG that are taken into an EO workshop for inspection or maintenance are to be handled as if they were EO of the HCC assigned to them for storage purposes.

Annexes:

A. Storage of Non-Explosive Dangerous Goods in Explosive Ordnance Storage Areas.
B. Non-Explosive Dangerous Goods - Special Markings

ANNEX A

STORAGE OF NON-EXPLOSIVE DANGEROUS GOODS IN EXPLOSIVE ORDNANCE STORAGE AREAS

1. Articles or substances of dangerous goods other than class 1 dangerous goods, known as Non-Explosive Dangerous Goods (NEDG), ideally should be stored in separate facilities. However, in special circumstances, where the storage of NEDG of various classes has been deemed essential within an Explosive Ordnance (EO) storage area, such storage must be authorised by the Licensing Authority (LA).

2. Advice on the treatment of NEDG stored within EO storage areas is contained in the tables below. Pseudo Hazard Classification Codes (HCC) for each item will be assigned by the Explosives Storage and Transport Committee (ESTC) of the Directorate of Ordnance Safety (DOS) and are available for viewing in the Defence Explosive Ordnance Classification List (DEOCL). NEDG may be stored in an EO storage area at the prescribed Quantity Distances (QD) appropriate to the assigned pseudo HCC. Any further advice required can be obtained from the ESTC.

3. This annex does not contain information for the storage of NEDG outside an EO storage area. This information can be found in the Hazardous Chemical – Storage Segregation Guide for Workplaces.

Note:

> The lists of articles and substances contained in the tables below are not exhaustive nor are they designed to be.

Articles of EO that contain NEDG

4. Table 1A-1 contains treatment information when stores within an EO storage area for weapons or weapon components filled with NEDG substances when stored within an EO Storage Area.

Bulk Liquids

5. Table 1A-2 contains information regarding the treatment of some NEDG bulk liquids when stored within an EO storage area.

ANNEX A

<table>
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Table 1A-1: Treatment of some NEDG in EO storage areas

ANNEX A

Type of DG	Examples	EO Storage Area allowed	Underground Storage allowed	Type of Storage for DG	Minimum distance between DG and any building or stack containing EO
Dangerous liquid substances other than Class 1 when stored in bulk	Aviation Spirit Gasoline/Petrol High Test Peroxide (HTP) Inhibited Red Fuming Nitric Acid (IRFNA) Isolpropyl Nitrate (IPN) Methanol/Water Mixed Amine Fuel (MAF) Otto Fuel Perchloric Acid Electrolyte Potassium Hydroxide Electrolyte Diesel Fuel Kerosene Paraffin Lubricating Oils	NO – are to be excluded from explosive ordnance storage areas unless absolutely essential and authorised. YES YES YES YES	YES YES NO NO NO YES NO NO NO NO YES YES YES YES	1. Surface storage with a surrounding bund wall capable of holding the whole of the contents with a special provision for segregated drainage. OR 2. Surface storage with a protective roof of 150 mm reinforced concrete and a surrounding bund wall capable of containing the whole of the contents and of sufficient strength to withstand blast loading and fragment attack with special provision for segregated drainage. The wall should be protected by earth heaped against it. OR 3. Underground storage site covered by at least 100 mm of concrete or 600 mm of earth.	When Type 1 storage buildings are used, these storage places should be sited at least at the IBD from any EO building in the area. Where POL facilities are vital, a minimum distance of 450 m applies from sites containing HD 1.1 and/or 1.2 EO. When Types 2 or 3 storage sites are used, such sites should be sited at least at twice the D4 distance from HD 1.1 EO with a minimum distance of 25 m. The separation distance from EO of HDs 1.2, 1.3 or 1.4 should be a minimum of 25 m.

Table 1A–2: Treatment of some Dangerous Goods Bulk Liquids in EO storage areas

ANNEX B

NON-EXPLOSIVE DANGEROUS GOODS – SPECIAL MARKINGS

SODIUM PHOSPHIDE

DANGEROUS IF NOT KEPT DRY

THE CONTENTS OF THIS PACKAGE ARE LIABLE, IF BROUGHT INTO CONTACT WITH MOISTURE, TO GIVE OFF A SPONTANEOUSLY FLAMMABLE GAS

Type of NEDG	Class of Dangerous Goods		Examples	Type of storage for NEDG		Minimum distance between NEDG and any building containing explosive ordnance
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Ammonium nitrate	5.1	1942	Prilled ammonium nitrate			Treat the NEDG as UN HD 1.1
Ammonium perchlorate (>44 microns)	5.1	1442				
Aniline and furfuryl alcohol	6.1	1547 2874	Aniline and furfuryl alcohol in drums			Treat the NEDG as UN HD 1.3
Calcium phosphide	4.3	1360	Candles white smoke (not Mk N6). Lights indicating torpedo/ lifebuoy			
Chlorosulphonic acid	8	1754	Bombs aircraft practice smoke filled CSAM			
Dichlorodiethyl sulphine	6.1	7027 (Provisional)	Bottles steel 1 L			
Hexachlorobenzene	6.1	2729	Smoke composition			
Hydrogen peroxide	5.1	2014 or 2015	Some torpedoes of United States design			
Iso-propyl nitrate and methanol	3.1	1222 1230	Generator gas chemical warfare Mks 1 and 2	Surface	Storage	
Magnesium/Iron powder/Lithium hydride	4.3	1418 1414	Submarine bubble decoy Mk N2			Treat the NEDG as UN HD 1.3
Match composition	4.1	2254	Matches fuze safety. Matches fuze safety No 4. Matches safety flamer No 4. Matches Waterproof safety Nos 4 and 5. Matches fuzee.			
Nitrocellulose	4.1	2555 2556 2557	Combustible cartridge cases. Caps and discs for same			
Nitromethane	3	1261	Used for cratering. Store without heavy confinement. Standard drums stacked not more than two drums high			

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REGULATION 4.4 - FACILITY OPERATIONS

General Overview

4.1 The purpose of this chapter is to provide guidance for authorities on the promotion of safe and efficient operations in Explosive Ordnance (EO) areas. It contains considerations which may serve as an aid to users in the preparation of instructions on the subject. Occupational health and safety issues of operations in explosive ordnance areas are to be conducted in accordance with the requirements of the Defence Safety Manual (SafetyMan).

Requirements

4.2 All EO facilities under the control of Defence must be operated in accordance with this regulation and the associated procedures.

SAFETY PRECAUTIONS

General

4.3 **Posting of Warning Notices.** Notices are to be posted in a prominent position at the entrance to EO areas and at each facility not situated within a compound having controlled access.

4.4 **Industrial Safety.** Personnel are to be made aware of explosives and industrial safety.

4.5 **Compliance to regulations.** Staff involved with the handling or use of EO are to comply with all regulations and procedures which may affect them in the course of their duties.

4.6 **Patrolling and Guarding of EO Areas.** Each entrance is to be guarded. When the entrance is not guarded they are to be closed and secured. Every EO area is to be patrolled in accordance with the requirements of the Defence Security Principles Framework (DSPF).

4.7 **Control of Keys.** The keys of all gates and doors to EO areas and facilities, when not in use, are to be deposited in a safe place authorised in accordance with the DSPF.

4.8 **Thunderstorms.** Work involving EO and in buildings containing EO is to cease during thunderstorms and personnel should be evacuated to a suitable location at the appropriate distance from Potential Explosion Sites (PES). When a thunderstorm is imminent, truck loads of EO should be moved undercover. Loads which must be left in the open should be covered.

4.9 **Provisions for Medical Facilities.** Provision is to be made for first-aid and medical attention at least to the standards issued by Worksafe Australia. Details of the arrangements are to be made known to all personnel.

4.10 **Lighting of Fires.** The lighting of fires is strictly prohibited unless specially authorised by the OIC of the establishment.

4.11 **Locations for Work on EO.** Work in EO areas is to be carried out in locations prepared and designated for the purpose.

4.12 **Inspection of EO Facilities.** All EO facilities are to be inspected periodically.

Personnel

4.13 **Personnel employed in EO Areas.** A person should not be employed in the EO area unless the CO/OC/director/superintendent is satisfied that the person is suitable for such employment.

4.14 **Workplace Induction.** Before commencing work in an EO area each person is to be formally inducted into the workplace by receiving instructions on the basic safety precautions required in the area.

4.15 **Admission to EO Areas.** No person must enter an EO area except by authorised entrances, and only then under authority of a pass issued by the CO/OC/director/superintendent or other officer-in-charge. Personnel are not to remain in the EO area after their authorised duties have ceased.

4.16 Any person showing the least signs of intoxication or impairment from drugs must not be admitted to EO areas.

4.17 All persons, including visitors, before entering an EO area or facility, are to search their pockets and are to deposit outside the entrance any prohibited article that they have with them. All persons may be challenged for prohibited articles. A proportion of employees should be challenged on a random basis.

4.18 **Employee Working Alone.** No one person should be permitted to work alone (or in a situation where another person cannot provide immediate assistance in case of an accident) in explosives workshop or laboratory operations which involve the assembly or breakdown of EO or the exposure of explosive fillings, or in any other operation which involves the opening of packages and the exposure of loose EO.

4.19 **Wearing of Rings and other Jewellery.** Good industrial safety practices discourage the wearing of rings and other jewellery by personnel employed in workshops. Rings and other jewellery should not be permitted in EO workshops.

Controlled Activities

4.20 **Prohibited and Restricted Articles.** No stores, other than EO which has been properly classified and authorised for storage therein, and such tools, appliances and materials as are authorised from time to time, are to be permitted into an EO area.

4.21 A list of specific items to be prohibited or strictly controlled is located in Regulation 4.4 Procedure 1, Annex B.

4.22 **Food and Drink.** When approved by the Licensing Authority tea rooms may be located within the EO area.

4.23 **Smoking.** Smoking inside EO areas is strictly forbidden except in authorised smoking areas.

4.24 Prominent signs are to be displayed at each exit from the smoking area with the wording:

'NO SMOKING BEYOND THIS POINT'

A sign with the wording:

'WARNING NO LIVE AMMUNITION OR EXPLOSIVES ARE PERMITTED IN THIS AREA'

should be placed at or near the entrance to the smoking area.

4.25 **Private Motor Vehicles.** Standing orders are to include regulations to cover local conditions for the certification, control and use of private vehicles in an EO area.

4.26 **Portable Hand Lights.** Portable hand lights may be used within the EO area if they are of a design that meets the electrical requirements for the particular building/area in which they are to be used.

4.27 **Battery Operated Devices.** Battery operated devices may be used in locations within the EO area at the discretion of the CO/OC/director/superintendent. Only 'intrinsically safe' devices should be approved for use in those areas where EED, explosive dust or other conditions which might give rise to an explosion are present. To be 'intrinsically safe', the device should be incapable of producing sufficient energy to initiate an explosion.

4.28 Photography. Photographs taken within the EO area should be restricted to those required for official purposes. Where EO is exposed, Electro-Explosive Devices (EED) are involved or explosive dust or flammable gases may be present, the use of cameras with electrically operated equipment should be avoided unless specially approved for the purpose.

4.29 Radioactive Materials. As a general rule, radioactive material (except depleted uranium EO—see Regulation 5.4) should not be stored within an EO area. If it is necessary to keep such material inside an EO area, it must be kept in a separate building of robust construction. The building must be separated from the nearest PES by at least process building distance for the EO involved. If the radioactive material is stored underground, the separation distance must be as if the material belonged to Hazard Division (HD) 1.1. If a building not of robust construction is used, the separation distance must be at least the inhabited building distance from a PES.

Operations in an explosive ordnance storehouse

4.30 Explosive Content Boards. An Explosive Content Board is required to record the Net Explosive Quantity (NEQ) stored within the facility at any given time.

4.31 Permitted Operations in a Storehouse. Work on EO permitted in storehouse is limited to banding, stencilling, labelling and desiccant renewal where the container is not opened. For the purposes of Annual Ordnance Inspections, an authorised inspector may open 'closed' or 'fraction' containers to verify and validate the contents provided the individual package is removed to the exterior of the storehouse and the access door is closed prior to opening the container.

4.32 Cleanliness of Buildings. The cleanliness of all magazines and other buildings containing EO should be maintained at a high standard. The following precautions must be taken:

a. Dangerously combustible materials, such as paper, oily rags, cotton waste, paints, solvents, volatile liquids, and painting cloths required for use in an EOSH or workshop should be removed to a safe storage place when not actually in use;

b. Particular care should be exercised to avoid the presence of steel wool, sand, gravel, or any other abrasive substance upon the floors, tables, or other working places where EO is being handled;

c. Explosive dusts or vapours should not be allowed to accumulate inside or outside a building;

d. Electrical fixtures and motors should be kept free from dust; and

e. Special precautions to control personnel and EO (see paragraphs 4.39–4.43) should be observed when packages containing EO liable to initiation by spark or friction are stored and are not in dust tight containers.

4.33 Authorised Stores and Equipment. Only stores, tools and equipment authorised and required for use should be permitted in EOSH. A list of stores, tools and equipment approved for use should be displayed in the building. In particular, empty pallets and dunnage should not be allowed to accumulate in EOSH containing EO.

4.34 Electrical Extensions. When not specifically prohibited and when it is necessary to use extension lights during the handling, loading, or unloading of EO in magazines or other buildings or onboard vessels, lighters, railroad cars, trucks, or other vehicles, portable electric extension lights may be used provided they are in accordance with Regulation 6.3 Procedure 1.

4.35 Handling Equipment. Approved handling equipment should be used, maintained and inspected in accordance with the manufacturer's instructions and recommended maintenance schedules.

4.36 **Parking of Vehicles, Railcars and Barges.** Vehicles, railcars and barges should be parked in the vicinity of magazines and EO workshops only for the period of time required for loading or unloading. At all other times, designated holding or marshalling areas should be used for parking purposes. When such vehicles/vessels are moving through EO areas, routes should be used which minimise the risk of an explosion and propagation between PES.

Operations in Workshops and Laboratories

4.37 The special requirements for the repair, modification, inspection and proof of EO in explosive ordnance workshops and laboratories are detailed in paragraphs 4.38 – 4.69. These activities should only be conducted in the locations designated. The NEQ of EO permitted in workshops or laboratories should be governed by the Quantity Distance (QD) in Regulation 5.4 of this manual.

4.38 **Working Conditions.** The following working conditions are to apply to EO workshops and laboratories:

a. Clean conditions (see paragraphs 4.46 – 4.48) should be observed when explosive contents are exposed;

b. Each work area should be thoroughly cleaned daily and each time work is changed from one nature of explosive to another;

c. Before any article is taken into an EO workshop operating under clean conditions, it must be examined externally and any grit or other substance likely to violate the clean conditions removed;

d. Work benches on which explosives are likely to be exposed should be so situated that nothing can accidentally fall on the explosives;

e. Work should be arranged so that explosives are never exposed to direct sunlight;

f. EO not being worked upon should be kept covered;

g. Oils, spirits, paint, flammable/volatile liquids and other hazardous chemicals should be stored in accordance with SafetyMan, in sound containers which, in turn, should be kept in a metal tray the size of which should be adequate to contain spilling. The quantity of such liquids should be kept to a minimum. During non-working hours or when not in use, they should be kept in a metal locker outside the building or in a special fireproof room/container consistent with Hazardous Chemicals Management Procedure 19 - Cabinets and Cages for Storage of Hazardous Chemicals. These lockers should be included in the daily security check. EO laboratories may store hazardous chemicals in accordance with Procedure 5 paragraph 5.28 and, providing the laboratory building has access control, daily security checks of DG containers are not required;

h. All doors in EO workshops not equipped with quick release hardware must be unlocked when work is in progress;

i. Protective shielding should be erected around assembly or disassembly apparatus to protect operators against flash and splinters in case of accident. Protective shields should be proof-tested prior to initial use and only used for the purposes for which they have been proof-tested;

j. When movement of unpackaged EO is necessary, care must be taken to ensure that it is securely held and is protected against damage and dislodgment;

k. EO containing exposed percussion caps or primers should have the caps protected from accidental striking by means of cartridge clips, or similar;

l. EO containing an EED should not be removed from its package for longer than is essential so as to minimise the time during which it may be susceptible to electromagnetic radiation. Whenever it is necessary to remove EO of this kind from its package, the safe distances from radio frequency sources should be observed;

m. Rooms for handling grenades, and other similar small stores, should be provided with a disposal chute, or equivalent facility;

n. Workshops or parts of workshops used for paint or rust removal should not be considered as clean areas while being so used. They should be thoroughly scrubbed and cleaned before being included in a clean area;

o. Paint or rust removal and painting operations should not be conducted in the same workshop room;

p. Any painting operations conducted in the adjacent bays of the workshop to explosives bays must be equipped with efficient fume removal systems or not operated when explosives operations are in progress (see also paragraph 4.54);

q. Ovens for drying non-explosive components should not be located in clean areas or EO workshops; and

r. Non-ferrous metal receptacles should be appropriately located at workplaces when there is a possibility of loose explosives or propellants being scattered on floors or work benches.

4.39 **Personnel and Explosives Limits.** To reduce the risk of injury to personnel and damage to property, the number of personnel employed, and the quantity of explosives within an EO workshop, should be kept to the minimum required to maintain the operation. Dividing the overall quantity into separate bays or rooms, with substantial internal walls or barricades, will reduce the risk of explosive propagation and probably reduce the effects of an explosives accident. The personnel and explosives limits vary with each operation and should be included in the Standard Operating Procedure (SOP).

4.40 A personnel limit is to be assessed for each building, room or area in accordance with the following principles:

a. The number of persons employed should be the minimum compatible with the highest standards of safety, quantity and an even flow of work;

b. The personnel limit should include all persons employed including those employed on the movement of the EO or on other tasks in the immediate vicinity;

c. The limit should include supervisors or inspectors if they are present for more than 1 hour per day; and

d. The limit should be related to the size of the building and the number of exits. Irrespective of other considerations, each person is to have ample working space and suitable evacuation routes.

4.41 A working explosives limit for each building, room or area should be assessed in accordance with the following principles:

a. It should not exceed the quantity permitted by available QD;

b. The limit should represent the minimum number of containers or rounds required to maintain an even and continuous flow of work;

c. The working limit should include all explosives held within the building and the immediate vicinity. It should also include EO that have been processed or waiting to be processed, whether on vehicles or on the ground; and

d. The possibility of reducing the hazard presented both inside and outside the building by the use of adequate internal traverses should be considered.

4.42 Signs should be conspicuously posted to provide the following information:

a. The nature and type of the EO being processed;

b. Details of the operation, eg re-boostering;

c. The compatibility group, HD and fire class of the EO; and

d. Personnel and explosives limits.

4.43 This information should be repeated as necessary for rooms or confined areas where special working conditions are prescribed. The explosives limits may be stated in terms of NEQ and/or number of rounds or containers.

4.44 **Standard Operating Procedures.** A standard operating procedure (SOP) should prescribe step-by-step procedures to control operations and the precautions to be taken in the course of workshop and laboratory operations. It should be available in the building for the operation in progress.

4.45 A SOP should be approved by the CO/OC/director/superintendent and include, as applicable:

a. Drawings, specifications, gauge schedules, tools, apparatus, and restriction lists;

b. Static electricity grounding (earthing) requirements;

c. Maximum and/or minimum humidities;

d. Clothing and footwear requirements;

e. The maximum number of personnel to be in the workshop or laboratory at any one time;

f. The maximum quantity of EO permitted in the building and/or to be worked on at any one time; and

g. Additional safety precautions applicable to the EO being worked on.

4.46 **Clean Working Areas.** Clean conditions may be described as a set of precautions that are taken in EO laboratories, workshops, proof areas, and certain magazines, to prevent the introduction of, or the contact of explosives with, extraneous matter such as ferrous metals, aluminium or aluminium alloys or grit which might cause an explosion through friction or spark.

4.47 Working areas that are required to be maintained under clean conditions should be provided with a changing lobby. The lobby should be divided by a barrier to separate the clean area from the ‘dirty’ area.

4.48 **Clothing for Clean Conditions.** Clothing used in EO workshops or laboratories maintained under clean conditions should be specified by the licensing authority, and will normally include items such as spark-proof conductive footwear, flame-proofed smocks or coveralls and suitable hair covering.

4.49 **Static Electricity Precautions.** EO workshops should be provided with conductive or antistatic flooring. Conductive flooring is designed to provide a path of conductivity for the free movement of electrostatic charges, thereby preventing a charge accumulation, see Regulation 6.3 Procedure 2.

4.50 Antistatic flooring differs from conductive flooring in that it offers greater resistance to the passage of electrical current.

4.51 Grounding (earthing) points should be available for equipment, tools and EO in EO workshops, to prevent a difference of electrical potential between operators and the material that they must handle.

4.52 Conductive/antistatic flooring and grounding (earthing) systems should be tested for continuity in accordance with the manufacturer's specifications, Australian Standards and any Defence regulations.

4.53 Personnel working in EO workshops should wear appropriate footwear and/or other antistatic devices when conductive/antistatic flooring is present. Such safety devices should be tested daily when in use.

4.54 **Painting Operations.** In accordance with standard good workshop practice:

a. Painting and stencilling operations should only be conducted in well ventilated rooms or outdoors;

b. Spray painting operations, when conducted indoors, should be done in spray painting booths, except for minor touch up or stencilling using low pressure spray markers or aerosol containers; and

c. Operators and helpers should wear protective masks while spray painting is in progress, unless the spray booths are properly exhausted so as to preclude exposure of personnel to toxic atmosphere.

4.55 **Heat Sealing Equipment.** The use of heat sealing equipment for packaging of EO in polyethylene is permitted under the following conditions:

a. The EO is suited to heat sealing;

b. Only heat sealing apparatus approved in the SOP is used;

c. The heat sealing equipment is used in accordance with the manufacturer's instructions; and

d. The heat sealing equipment is properly maintained and inspected for serviceability and cleanliness before initial use and at the beginning of each shift, and should be checked for cleanliness (absence of any spillage) before each operation.

4.56 The use of heat sealing equipment within a transit magazine or EO workshop should be restricted to use in a room or segregated area apart from other activities. However, heat sealing equipment must not be permitted in a room maintained under clean conditions.

4.57 Items to be heat sealed should be in serviceable condition and free of defects.

4.58 Detonators and heat sensitive items, such as propellant or explosive samples should be suitably packaged before heat sealing.

4.59 **Tools.** Only non-sparking tools should be used in direct contact with exposed explosives or in rooms maintained under clean conditions.

4.60 Special or locally designed tools and equipment should not be used in EO operations nor should modifications or alterations to approved tools or equipment be made without prior technical approval from the Service Headquarters / Defence Science and Technology Group (DSTG).

4.61 Tools and appliances designed and provided for particular EO operations should not be used for other purposes without approval of the Service Headquarters / DSTG.

4.62 Only those tools authorised for use by the applicable SOP for the operation being performed should be permitted in the room or area.

4.63 **Disposal of EO Packaging and Scrap.** All empty EO containers, packaging materials, empty cartridge cases, empty EO components, and the like, received from user units should be given a 100 per cent inspection and certified free from explosives in accordance with Regulation 28 of Explosives Transport Regulations 2002 Statutory Rules No. 92, 2002 (ETR), before being declared as scrap, Government provided material in aid to production, or otherwise disposed of.

4.64 Suitably trained and competent personnel are to be appointed by unit managers to perform this duty.

4.65 **Supervision.** Constant supervision should be maintained by supervisory staff and all personnel should be safety conscious. Each operator should be fully acquainted with any hazards associated with the EO on which they are required to work. Before commencing an operation each operator should be familiarised with the particular task that will be performed.

4.66 **Accidents/Incidents involving EO.** In the event of an accident or incident involving EO, all operations must cease immediately and the situation must be reported to the CO/OC/director/ superintendent. Nothing must be disturbed, except in the interest of safety or as may be necessary to give assistance to injured persons. Precautions must be taken to prevent unauthorised personnel from entering the area.

4.67 Accidents involving EO must be reported in accordance with these guidelines and other departmental regulations (see Regulation 1.3).

4.68 **Close-down of EO Workshops.** When an EO workshop is vacated, all electrical installations and powered equipment, other than essential services, should be switched off or disconnected. At the end of each working day the building should be secured.

4.69 EO remaining in the building should be subject to the following:

a. During temporary breaks within the course of a working day, the EO may be left in position provided it is safely stowed, and the explosive composition is not exposed; and

b. At the end of each working day EO may be left in the work area providing it is packaged, (except for EO which are not normally stored in packages) and placed on the floor. Items should be grounded (earthed) as appropriate.

Operations in a Magazine

4.70 The general requirements applying to EO areas and storage facilities, except that no inspection or maintenance operations are permitted within magazines.

4.71 Admittance within the barrier of a magazine is confined to those on duty therein. Before entering, all persons are to search their pockets to ensure the absence of prohibited articles.

4.72 All persons entering a magazine are to observe the rules governing the maintenance of 'clean conditions'.

4.73 Cleanliness is of vital importance in magazines. Cleaning implements, which are to be made of non-ferrous metal, are to be kept to a minimum. The wheels and fittings of all trucks used in magazines are to be of copper or copper alloy. All floors and platforms are to be cleaned frequently. Fittings are to be kept free from dust or grit.

Operations in a Preparation Facility

4.74 All explosive safety requirements for workshops prescribed within this regulation apply to preparation facilities.

Operations in a Guided Weapons Facility

4.75 All explosive safety requirements for workshops prescribed within this regulation apply to Guided Weapons Facilities. Additional operating requirements are as follows:

a. **Roadways.** Vehicles and personnel are not permitted to proceed beyond activated red lights on approach roads without permission from the appropriate weapons supervisor.

b. **Explosive Testing.** All testing of Guided Weapons with explosives or propellants present are to be conducted remotely within a test cell, except where deviation has been authorised by Directorate of Ordnance Safety. No personnel are permitted in the test cell or the surrounding area while the test is being conducted.

c. **Weapons Assembly Room Loading Doors.** The main loading door between the weapons assembly room and its loading bay is to remain closed during remote tests.

d. **Loading Bays.** Loading and packaging operations are not permitted at a loading bay when remote testing are being conducted in an adjacent test cell.

Operations in an Under-Precautions Facility

4.76 All explosive safety requirements for workshops prescribed within this regulation apply to under-precautions facilities.

Maintenance of Watercraft, Vehicle or Aircraft Components containing Explosives

4.77 All explosive safety requirements for workshops prescribed within this regulation apply to facilities or areas used to conduct the maintenance of Watercraft, Vehicle or Aircraft Components containing explosives.

Burning and Demolition Grounds

4.78 **Authority for Disposal of Explosive Ordnance.** EO is not to be destroyed with confirmation of sentence unless the EO is considered to be in a dangerous condition or it has been recovered from an EOD operation.

4.79 **Record of Disposal.** Detailed and accurate records of burning or demolition activities are to be maintained in a hardbound book with numbered pages.

4.80 **Disposal Operating Hours and Conditions.** The hours and operating conditions which destruction is permitted are to be specified.

4.81 **Prohibited Articles.** The articles which are prohibited or restricted in EO Areas are also to be controlled in burning and demolition grounds.

4.82 **Communications.** Communications are to be established between the demolition shelter or the firing point, the sentry posts and the establishment’s administration area.

4.83 **Control of Access Personnel and Vehicles.** Control of the burning or demolition ground, personnel and vehicles are to be established during operations.

4.84 **Special Fire Precautions.** Special fire precautions are to be undertaken prior to disposal activities being conducted.

4.85 **Conduct of Operations.** The following requirements are to be undertaken prior to the commencement of any disposal activity:

a. Notification to Civilian Authorities;

b. Warning to Establishment Staff;

c. Communications are to be established;

d. First Aid/Medical arrangements are to be made in advent of an emergency;

e. Inspection of Demolition Shelter;

f. Fire Prevention and Fire Fighting checks are to be conducted;

g. Escape Routes are to be planned in the event of an emergency;

h. Warning Flags and Sentries are to be posted. Sentries are to be briefed prior to placement;

i. Restricted Articles are to be controlled;

j. EO is to be secured at a identified storage location at the burning or demolition ground;

k. Personnel involved in the disposal task are to wear protective dress.

l. Operation is to be conducted via approved operating instructions, that include procedures for misfire; and

m. Post disposal activities are to be completed.

4.86 **Packages and Produce.** All packages and range produce is to be collected and processed in accordance with relevant instructions, eg empty packages inspected, processed and certified Free From Explosives.

4.87 All personnel, including sentries are to be warned by the Conducting Officer that the removal of range produce is forbidden and of the consequences of removing range produce from these areas.

4.88 **Inspection of Burning and Demolition Grounds.** Burning and Demolition Grounds are to be inspected for the following aspects at least every three months:

a. Cleanliness;

b. Serviceability of boundary fences;

c. Serviceability of fixed communications;

d. Signposting;

e. Serviceability of fire fighting equipment;

f. Fire breaks; and

g. Estate management.

4.89 **Surrender of Burning or Demolition Grounds.** When a burning or demolition ground is no longer required it is to be surrendered.

Use of Explosives for Displays and Demonstrations

4.90 **Licensing.** Display areas are to be licensed by the Licensing Authority.

4.91 **Display Management.** For each display a Safety Officer is to be appointed by the Officer in Charge (OIC) of the unit concerned with organising the display.

4.92 **Operation of Displays.** The operation of the display is to be in accordance with the provisions of AS 2187.4 – 1998.

4.93 **Competency of Display Operators.** Defence staff trained in the use of Defence EO are not to be assumed as competent firework Display Operators. Displays are not to be conducted by Defence personnel who are not trained in their use. The Display Operator is to be licensed under the relevant State legislation. If military EO or commercial explosives (not Fireworks) are to be used, the Safety Officer is to hold current Defence qualifications to initiate the items used.

4.94 **Safety Assessment of Display.** Displays are to be conducted within the requirements and the spirit of the explosive safety rules in AS 2187.4 – 1998 and this manual.

4.95 **Significant Public Firework Display.** When significant Defence assets are to be used in conjunction with a public firework display single Service safety authorities have prime responsibility for the safety of those assets and spectators, and are to ensure that appropriate risk assessments are conducted.

4.96 **Use of Defence Explosives.** Defence owned or controlled EO is not to be used for non- public funded displays.

4.97 **Display Models and Props.** Display models or props built to be destroyed, or which may be potentially destroyed by explosives are to be constructed from non-lethal fragment producing materials such as paper, cardboard, polythene, plastic ties and adhesive tape etc.

4.98 **Post Display Actions.** The Safety Officer is to conduct a clearance of the display site and a post display evaluation. The evaluation report is to be forwarded to the Explosive Ordnance Licensing Authority (EOLA) within the Explosive Ordnance Branch.

Principles for the Operation of Small Quantity Facility

4.99 SQF are to be in the charge of an appropriately qualified and responsible person who is to ensure the safe custody of the EO at all times. SQF are to be operated in accordance with the following principles. This list is in no way exhaustive and the instructions in Procedure 2 for the operation of EO storehouses in designated EO storage areas also apply where applicable:

a. Drill, dummy or instructional ammunition and weapons are not to be stored with live EO. The only exception to this is when an explosive or inert component is packaged separately from the parent item. Such components may be stored together, eg components of the Grenade Hand Practice F3.

b. Packaged kits, eg Ramset kits, and their components may be stored together.

c. Empty packages are not to be stored in SQF with live EO.

d. For security reasons, fired cartridge cases may be stored in SQF with live EO pending 'free from explosives' certification, and provided the cartridge cases are in a sealed container and clearly marked. Such storage is to be for the minimum time required.

e. Handling of EO is to be avoided during the approach or progress of an electrical storm.

f. Only those persons actually engaged in the handling of EO are to be in the immediate vicinity of such operations.

g. For EO of HD 1.1 and HD 1.2, the maximum use of unitisation to reduce external hazards is to be adopted. NEQ for each unitised quantity of EO is not to exceed 5 kg. Each unitised quantity is to be separated by at least 1 m from another.

h. Only properly packaged EO may be stored in SQF unless otherwise indicated on the licence.

i. Safes are not to be used as SQF except for storage of small quantities of smoke type stores and small arms ammunition (SAA). Safes so used are not to contain any other valuable and attractive items and are not to contain files and documents that would require the safe to remain unsecured for lengthy periods.

j. The storage of SAA in SQF is to be restricted to ammunition that is not of high explosive configuration and below a calibre of 19.1 mm.

k. Ball and blank SAA should be stored in separate SQF to reduce the possibility of contamination of blank ammunition with ball rounds.

l. Co-located SQF are to be separated by a minimum distance of 2.5 m otherwise the NEQ of each SQF are to be aggregated. However, relocatable magazines constructed in accordance with Australian Standard (AS) 2187 may be a minimum distance of 1 m from each other or to another SQF without aggregation.

m. EO from fraction containers, ie containers having fewer than the recognised full quantity, should always be used first.

n. Unpackaged EO, in particular SAA, is not to be stored in bags. EO that has been issued, and then returned unused, is to be packed into its authorised package before being placed in storage.

o. Packages containing EO that have been wetted are to be carefully wiped dry, especially around the lid, before being stored. Where the package is suspected or known to be not airtight, it is to be opened and the EO inside inspected and, if necessary, dried carefully item by item.

p. Packages are to be stored in SQF's in such a way that air may be circulated freely around and under them.

q. Articles such as paints, oils, chemicals, other dangerous goods and cleaning rags etc are not to be stored in SQF.

r. The issue or receipt of EO, from or to, packages in SQF is permitted provided all packages are subsequently closed (see Regulation 2.3 Procedure 4 paragraph 4.30b).

Transfer Operations at Wharves and Anchorages

4.100 The transfer of EO whether onto a road vehicle, ship or aircraft, exposes it to a higher level of risk than most other operations. It is therefore important that appropriate procedures that take into account the local conditions be developed to ensure maximum safety and efficiency during these operations.

Responsibilities

4.101 All personnel, including contractors, who are employed in, or through conduct of their duties are required to enter an EO facility, are responsible to ensure compliance with this regulation and the associated procedures.

Responsibilities of Commanding Officers/Officers Commanding/Directors/Superintendents/ Contractor Site Managers

4.102 The Commanding Officers (CO)/Officers Commanding (OC)/director/superintendent of an EO facility has primary responsibility for safe working and storage conditions within the facility. The following actions should normally be taken:

a. Establish and enforce personnel limits for EO facilities;

b. Establish and enforce explosives limits for all magazines, transit sheds/areas, outside stacks or hardstands, workshops, laboratories, proof areas and demolition and burning grounds;

c. Ensure that standard operating procedures are prepared, displayed in buildings and enforced for all examination, repair, renovation, modification, disassembly, assembly, proof and disposal (by breakdown, burning or demolition) of EO;

d. Establish and maintain appropriate explosives training for personnel, and review periodically working conditions within the EO area. Training is to include fire awareness instruction, fire prevention strategy, and practice in firefighting procedures;

e. Maintain blueprints, maps or drawings showing the locations of all buildings in the EO area, and the distances to public traffic routes, inhabited and uninhabited buildings on and off Defence property;

f. Maintain standing orders to take account of local conditions and to supplement regulations, other orders and instructions pertaining to the operation of the facility;

g. Implement an explosives safety program with a system of accident, incident, defect and malfunction reports and investigation complementary to these guidelines; and

h. Ensure that all facilities and equipment are maintained in a serviceable and safe condition.

Safety Responsibilities

4.103 To reduce the inherent hazards associated with their work, all personnel who, in the course of their duty, are required to handle EO must have a detailed knowledge of applicable orders or directives.

4.104 A high degree of care must be demanded of personnel who are in charge of, or are handling EO, where even a slight degree of negligence involves danger to life or damage to property.

4.105 It is the responsibility of all personnel to maintain vigilance to improve and develop safe practices, methods and attitudes.

Procedures

4.106 Procedures used to implement the requirements of this regulation are:

a. Procedure 1 – Facility Operations – General Instructions

b. Procedure 2 – Explosive Ordnance Storage Facilities

c. Procedure 3 – Underground Storage Areas

d. Procedure 4 – Magazines

e. Procedure 5 – Explosive Ordnance Workshops

f. Procedure 6 – Clean Conditions

g. Procedure 7 – Explosive Ordnance Preparation Facilities

h. Procedure 8 – Integrated Weapons Facilities and Guided Weapons Workshops

i. Procedure 9 – Under-precautions Facilities and Operations

j. Procedure 10 – Maintenance of Watercraft, Vehicle or Aircraft Components containing Explosives

k. Procedure 11 – Control and Operation of Burning and Demolition Grounds

l. Procedure 12 – Use of Explosives for Displays and Demonstrations

m. Procedure 13 – Principles for the Operation of Small Quantity Facilities

n. Procedure 14 – Transfer of Explosive Ordnance

o. Procedure 15 – Procedures for the Management of RADHAZ to Ordnance

PROCEDURE 1 - FACILITY OPERATIONS - GENERAL INSTRUCTIONS

INTRODUCTION

General

1.1 Operations with Explosive Ordnance (EO) involve hazards which are specific to the type of explosive being handled and the nature of the operation being carried out. In order to define the hazard involved in a particular operation it is necessary to know details of the explosives, quantity present, nature of operation, process conditions, etc. It is therefore difficult to provide detailed instructions that will cover every contingency, but the general instructions and principles outlined in this instruction are applicable in most situations.

1.2 It is a requirement not only to work in an orderly and prescribed manner, but to consider in advance, all the circumstances and consequences of any foreseeable event which could lead to fire or explosion and to minimise both the probability of such an event occurring and its potentially harmful effects.

Purpose

1.3 This procedure outlines the general requirements that experience has shown to be necessary for dealing safely with EO and potential explosives in EO areas and facilities.

1.4 The special procedures applicable to EO storehouses, magazines, workshops, preparation facilities, guided weapon workshops and integrated weapon facilities, and test, evaluation and proof facilities are given in later procedures in this section.

Necessity for Recognition of the Special Hazards

1.5 It is essential that all personnel, concerned with the administration of EO areas and facilities or who have occasion to enter such areas and facilities, should appreciate that such areas and facilities are places set apart for a special purpose. They have peculiar hazards that are not to be overlooked and which govern the actions of those responsible for the administration of such areas and facilities, and of those who work within them.

1.6 Because of the peculiar risks associated with EO areas, personnel are to spend no more time than is absolutely necessary in any facility in which EO is being stored, inspected or maintained.

GENERAL SAFETY AND SECURITY

1.7 The OIC is responsible for the safety and security of an establishment. The following procedures prescribe the minimum requirements against which regular inspections and audits are to be undertaken. OICs are to ensure that only personnel conversant with the general instructions prescribed in this procedure are authorised to work in EO areas or facilities.

Posting of Warning Notices

1.8 Notices are to be displayed in a prominent position at the entrance to EO areas and at each facility not situated within a compound having controlled access. The notice is to direct persons to the general instructions prescribed in this procedure governing the rules of entry to an EO area or facility. Typical Warning Signs must contain conditions of entry and controlled articles. An example is provided at Annex A.

1.9 Perimeter warning signs are also to be erected in accordance with the Defence Security Principles Framework (DSPF).

Emergency Controls and Safety Organisation

1.10 Arrangements are to be made within establishments to encourage awareness of explosives and industrial safety and to prevent accidents. Specific instructions covering fire and other emergencies are provided in Regulation 4.7 Procedure 1. Reliable, prompt communication between personnel working in explosives facilities and the establishment's emergency control centre is to be maintained.

1.11 All accidents are to be investigated immediately with a view to preventing their recurrence. See also Regulation 1.3.

1.12 Suggestions for improving safety are to be encouraged from all staff, followed up and the decision notified to the proposer.

Industrial Safety Measures

1.13 Personnel are to be made aware of explosives and industrial safety. The Work Health and Safety (WHS) Act imposes on Commonwealth employers and employees both a general duty of care and specific obligations in respect of workplace health and safety, and provides a framework within which employees may cooperate to address WHS issues. In addition, regulations governing precautions to be observed to guard against accident or injury to health are detailed in relevant industrial legislation. The following paragraphs amplify particular aspects.

1.14 **Statutory Requirements.** Supervisory personnel are to be fully acquainted with all industrial legislation relative to their sphere of responsibilities. In particular, supervisors at all levels from OIC downwards must appreciate that it is a management responsibility to ensure safe working conditions and a safe system of working. While unsafe practices by individual personnel are always to be actively discouraged, it is emphasised that one purpose of the relevant legislation is to protect personnel, as far as possible, from the consequence of their imprudence.

1.15 **Protective Clothing.** Issue of protective clothing is to be made in accordance with relevant industrial legislation awards and determinations or approved administrative arrangements. Supervisors must ensure that personnel use the clothing or equipment provided for their protection.

1.16 **Guarding of Plant and Equipment.** All dangerous parts of plant and equipment are required by law to be adequately guarded. Where there is a choice available between guarding a risk at source and providing personnel with protection against it, e.g. putting a window guard on a grinding wheel or supplying personnel with goggles, the first course should normally be followed. The reason for this choice is that safe working is then no longer dependent on the exercise of discretion by any particular work person.

1.17 **Safety Training and Guidance to Employees.** Safety training and guidance is to be given to all employees, with particular emphasis on young persons and new employees, to ensure that they can do their work safely and that they understand the dangers inherent in plant, equipment, etc.

Authorised Entrances and Exits

1.18 Entry to, or exit from, EO areas is to be only by way of places authorised by the Officer-in-Charge (OIC). These are to be as few as practicable for effective access control. Passage of personnel into and out of the area is to be controlled.

Authorised Entry to an Explosive Ordnance Area

1.19 No person is to be permitted to enter an EO area during normal working hours, unless he or she produces a current official pass applicable to the area in question authorised by, or on behalf of, the OIC, or is specifically authorised to do so by the OIC in person. Additionally, some visitors or contractors may need to be escorted throughout the EO area.

1.20 Authorisation to enter an EO area during normal working hours is not normally to apply to non-working hours. During non-working hours, no person is to be permitted to enter an EO area unless he or she is specifically authorised to do so by, or on behalf of, the OIC.

Use of Emergency Exits

1.21 Personnel employed in EO areas are to be aware of the position of both the normal and emergency exits of the EO facility in which they work. Emergency doors are to be clearly marked as such, both internally and externally. The approaches to and the exit routes from emergency exits are to be kept clear at all times.

1.22 Whenever a firefighting practice takes place, evacuation drills also are to be carried out, during which the emergency as well as the normal exits are to be used. The supervisor of the facility is to record the date of the practice and the time taken to clear the facility in the Emergency Control Room Incident Log Book. Comment is to be made on the adequacy or otherwise of the number of exits and the use made of them. Additional means of exit when considered necessary should also be recommended.

1.23 At such drills, workers in EO facilities are to be encouraged to make use of all available exits and to ignore the normal rules for entering and leaving such buildings. However, care must be taken to ensure that magazine clothing and shoes are free from extraneous matter before the workers are permitted to re-enter the building.

Egress of Personnel

1.24 Personnel are not to remain in the EO area after their authorised duties have ceased.

Control of Work Parties

1.25 Persons in charge of work parties are to know exactly how many people are under their control and where they are employed in order to facilitate rapid evacuation of personnel in an emergency.

Patrolling of Explosive Ordnance Areas

1.26 Every EO area is to be patrolled in accordance with the requirements of the DSPF and local security orders, as applicable.

Guarding of Entrances

1.27 Each entrance to an EO area, is to be guarded by sentries, Service Police, or security staff whose duty it is to prohibit entry by unauthorised persons and persons disqualified by these instructions; to scrutinise or search all persons before admitting them and to challenge them as to their freedom from prohibited articles, specifically mentioning matches, lighters, cigarettes, pipes, tobacco, and battery operated devices. When entrances are not guarded they are to be closed and secured.

Prohibited or Restricted Articles

1.28 Certain articles are not to be taken into an EO area without the authorisation of the OIC of the establishment. A list of some articles which are to be prohibited or strictly controlled is given in Annex B, however this list is not exhaustive. It should be noted that the articles prohibited in any particular situation will depend on the type of EO work being carried out. Notices showing lists of prohibited articles are to be posted at places where the effect is most telling, e.g. at the entrances to EO areas and the entrances to clean areas. Notices should be made up in accordance with the requirements of Australian Standard 1319-1994 (AS 1319-1994) Safety Signs for the Occupational Environment.

1.29 **Depositing Prohibited Articles.** Before entering an EO area, each person is to deposit prohibited articles in their possession at an appointed place until they leave the area. The appointed place is to be such that personal articles can be left with complete confidence as to their security.

1.30 Possession of a Prohibited Article. Any person who finds he/she is in possession of a prohibited article inside the EO area is to inform their supervisor immediately. Where a visitor is involved the escort is to be informed. In the interests of safety, anyone who declares that he/she has inadvertently taken prohibited articles inside the EO area, should not be penalised unless it is a repeated offence.

Search before Admission and Exit from Explosive Ordnance Areas

1.31 All persons, including visitors, before entering an EO area or facility, are to search their pockets and are to deposit outside the entrance any prohibited articles that they have with them. All persons employed in the EO area and visitors may be challenged for prohibited articles at the entrance before entering and when leaving. The challenge may be made by area guards or other persons authorised by the OIC of the establishment. A proportion of employees should be challenged on a random basis.

Persons under the Influence of Intoxicants or Drugs

1.32 Persons showing the least signs of being under the influence of intoxicants or drugs are not to be permitted to enter an EO area. No alcohol should be consumed during meal breaks. Anyone found in, or reasonably suspected of being in, such a condition within an EO area is to be removed and not allowed to re-enter without the permission of the OIC of the establishment, who may also take disciplinary action against the person concerned. This requirement is designed to exclude persons not fully and continuously responsible for their actions from working with explosives.

Firearms

1.33 With the following exceptions, firearms are prohibited within an EO area:

a. Signal pistols required in proof yards.

b. Small arms required on proof ranges.

c. Weapons in packs or pods, or for inclusion in packs or pods for approved ship, aircraft weapons systems, but only in authorised facilities.

d. Firearms carried by authorised personnel on defence or guard duties.

e. Firearms carried by authorised personnel for vermin eradication (see Regulation 4.5 Procedure 1).

f. Weapons stored in Enhanced Self Defence Capability (ESDC) lockers in accordance with Regulation 4.4 Procedure 13 Annex A paragraph 22.

Control of Keys

1.34 The keys of all gates and doors to EO areas and facilities are, when not in use, to be deposited in a safe place authorised for this purpose. Local arrangements for the custody of keys in accordance with DSPF are to be authorised by the OIC.

Storage of Authorised Explosive Ordnance and other Items

1.35 No EO, except as specified below is to be admitted into an EO area or facility other than the EO authorised for storage therein, nor tools, appliances, building material or any other items other than those authorised from time to time in accordance with these procedures. Exceptionally, if EO not recognised as an in-service item of EO is received, it may be stored by segregating or isolating it, as appropriate, under local restriction until its acceptability has been determined or arrangements made for its disposal.

Storage of Private Explosive Ordnance

1.36 Private EO lawfully in the possession of persons living in on military base accommodation may be stored with the permission of the OIC. The EO is to be clearly identified and segregated from all other Service EO.

Surrender of Explosive Ordnance Not Authorised for Retention

1.37 There are occasions when user units find EO that is not accounted for. For example, the unit store may locate some live rounds of small arms ammunition in a collection of empty fired brass from a range practice. There are also instances when personnel ‘acquire’, accidentally or otherwise, items of EO during training activities. The continued retention, storage and possible use of the EO obtained under the circumstances described above, will contravene Service regulations and EO handling practices.

Use of Cameras within Explosive Ordnance Buildings

1.38 Only digital cameras are to be used in EO Facilities. Cameras must meet the electrical requirements for the zone that they are being taken into, as promulgated in Regulation 6.3 Procedure 1.

Battery Powered Devices in Explosive Ordnance Areas

1.39 Commercial battery operated devices such as watches, calculators, pagers, transistor radios etc are not normally designed to meet the exacting requirements for explosives safety. No such device is to be taken into EO facilities unless it complies with the electrical requirements of Regulation 6.3 Procedure 1.

Use of Audio Players in Vehicles in Explosive Ordnance Areas

1.40 The requirements for the use of audio players in vehicles within EO areas are set out in Regulation 3.1 Procedure 1.

Use of Mobile RF Emitters and Cellular Mobile Telephones

1.41 Conditions covering the use of mobile RF emitters and cellular mobile telephones are set out in Regulation 4.4 Procedure 15.

Roads

1.42 Roads leading to and in EO areas are to be maintained in a good state of repair to lessen the risk of accident to vehicles. Speed limits are to be strictly adhered to (see Regulation 4.6 Procedure 2).

Works Services in Explosive Ordnance Areas

1.43 Works services in EO areas and facilities are permitted under the conditions prescribed in Regulation 4.5 Procedure 2.

Vehicles and Material Handling Equipment

1.44 Vehicles and Material Handling Equipment (MHE) are permitted in EO areas and facilities under the conditions prescribed in Regulation 4.6 Procedure 2. Vehicles not directly involved in loading/unloading operations outside facilities are to be parked well clear of all exits.

SAFETY AND WELFARE OF PERSONNEL

Provision of Medical Facilities

1.45 Provision is to be made for first-aid and medical attention at least to the standards laid down in the Defence Safety Manual (SafetyMan). Details of the arrangements are to be made known to all personnel.

Smoking and Carrying Smoking Materials

1.46 Smoking is strictly prohibited in an EO area or facility, except in places designated as smoking areas and authorised by the OIC of the establishment. The conditions are to include special arrangements for taking smoking materials through the EO area, similar to the requirements detailed in paragraph 1.48 for the taking of matches into an area.

Lighting of Fires

1.47 The lighting of fires is prohibited in the EO area unless specially authorised by the OIC of the establishment, e.g. for vegetation control (see Regulation 4.5 Procedure 1) or during a disposal activity.

1.48 When authority has been given for a fire to be lit, safety matches only are to be used for the purpose. The matches are to be taken into the area in locked boxes painted bright red, either by the OIC or another person authorised for this duty, who may be the person authorised to use them. When taken into the area by someone other than the user they are to be handed over, at the point where the fire is to be lit, to the person responsible for lighting the fire. The user is to keep the key in his possession and is to allow no other person to have access to the matches, and is to use them only for the purpose for which they have been authorised. Unused matches are not to be left in the area overnight and are to be brought out of the area only by the person who carried them into the area or other authorised person. The authorisation referred to above is to be given in writing, by the OIC of the EO area or other nominated officer, and is to state the purpose for which the matches are required.

1.49 Fires are not to be left unattended and are to be completely extinguished before the end of the working day.

Actions on Approach of a Thunderstorm

1.50 Whenever an electrical storm (thunderstorm) approaches the near vicinity of an EO area the OIC of the establishment is to direct whether or not to close down EO facilities and evacuate personnel from the area. OIC are to detail how and when shut down provisions are to be put into effect by the issue of comprehensive local instructions. As a minimum these local instructions are to address the aspects raised in paragraphs 1.51 to 1.53.

1.51 **Thunderstorm Warning.** Timely warning of the approach of a thunderstorm to an EO area may be obtained as follows:

a. Whenever possible, arrangements should be made with the nearest Meteorological Office to provide advance warning of approaching thunderstorm conditions.

b. An electrical storm may be considered in the ‘near vicinity’ when the time between the lightning flash and the thunder report is between 15-30 seconds. This will place the discharge approximately 5-10 kilometres from the observer.

c. There may be occasions when, although no thunderstorm activity has been seen or heard, the sky/cloud conditions (cumulonimbus clouds) in the area indicate that an electrical discharge is an imminent event. In these circumstances, the OIC may liaise with the nearest Meteorological Office before deciding whether or not to instigate shutdown procedures.

1.52 **Action on Receipt of Warning.** When a warning of thunderstorm conditions is received, all work in the EO area is to cease and evacuation of buildings or sites is to commence. Trucks containing EO are to be moved into shelter if practicable. Any open truck that cannot readily be moved should be covered. Where the supervisor of a specific building considers it unsafe or impracticable to suspend work or the process in hand, the OIC may authorise work in that specific site or building to continue with the minimum number of personnel necessary. However, work on EED and primary explosives must not be carried out when thunderstorms are close by.

1.53 **Procedure for Vacating Buildings.** When personnel are directed to vacate EO buildings the supervisor present is to ensure that:

a. All exposed explosives are covered;

b. Windows, shutters and ventilators are closed;

c. The building is vacated promptly;

d. Electricity is switched off at outside switches; and

e. Doors are shut and locked.

1.54 Thunderstorm Conditions during Vessel/EO Operations. Instructions addressing thunderstorm conditions during EO operations involving vessels are given in ABR 862 Volume 2 Chapter 5 Paragraphs 5.41 to 5.42.

1.55 Food and Drink in Explosive Ordnance Areas

1.56 Intoxicating liquors are not to be taken into an EO area unless authorised by the OIC. Food and non-intoxicating drinks may be admitted into an EO area subject to the prior approval of the OIC, but only when it is difficult or inconvenient to arrange for personnel working there to leave the area for the purpose of taking refreshments. For reasons of hygiene, the consumption of food is not permitted in EO facilities which do not have ‘tea room’ facilities attached. Such tea rooms should not have direct access from rooms in which EO is handled.

1.57 It is important that personnel who handle EO wash before handling food.

Personnel Limits

1.58 All EO facilities are to have a Personnel Limit applied and a notice showing the limit is to be displayed. The limit is to be assessed on an individual site basis, and should reflect the minimum number of personnel necessary to allow EO operations to proceed smoothly and effectively in and around that site. This limit may be exclusive of transitory supervisory staff and authorised visitors but may need to include extra staff for stock relocation tasks, and personnel on estate management tasks or personnel from other units collecting EO. Personnel limits do not apply if an emergency situation is in existence, for the period of that situation. Specific guidance on the determination and display of personnel limits for EO storage and workshops facilities is provided at Regulation 4.4 Procedure 2 and Procedure 5 respectively.

Employees Working Alone

1.59 Normally, persons engaged in work with explosives are not to work alone but where it is deemed necessary and approved, in accordance with the DSPF, it is essential that arrangements be made so that aid is readily available in the event of a mishap. In addition, regular contact is to be arranged and maintained.

Care in Dealing with Explosive Ordnance

1.60 In handling EO, safety is to be the foremost consideration. All types of EO are to be handled with care, and the application of undue force prohibited. Cleanliness, method and care in all explosives work are to be stressed and must take precedence over urgency; the attitude of pressing on without due regard for safety is unacceptable.

Explosive Ordnance Rough Usage

1.61 Where EO is deliberately and with proper authorisation subjected to dynamic testing at testing facilities appropriate protection must be provided.

Locations for Work on Explosive Ordnance

1.62 Unless otherwise authorised by the OIC, work in an EO area is to be carried out in locations prepared and designated for the purpose.

Explosive Ordnance in a Non-Explosives Environment

1.63 Where there is a temporary and unavoidable requirement to handle EO in non-explosives areas or buildings, prior approval of the Licensing Authority must be obtained. Precautions are to be taken to screen personnel from the effects of fire or explosion. It is particularly important to bear in mind that fragments arising from a container of explosives or metallic items touching or near explosives, may travel relatively long distances with lethal effects.

Restriction on Experimental and Development Work

1.64 Experimental and development work is not to be carried out in buildings where routine maintenance is proceeding. In compartmented buildings this work maybe carried out in one compartment while routine maintenance is proceeding in another compartment provided the OIC is satisfied that it is safe to do so.

Segregation of Explosive Ordnance

1.65 In areas where EO is being assembled, care is to be taken to keep apart different types of EO until they are brought together in an approved manner. For example, initiating devices are to be kept separate from secondary explosives.

Issue of Written Instructions

1.66 The special rules and operating instructions for processes involving EO must be prepared, approved and issued before work of any kind on EO or packages containing EO is undertaken (see Regulation 4.4 Procedure 5 and if applicable, Procedure 8).

Unusual Occurrences

1.67 All persons are immediately to report to higher authority anything unusual or apparently dangerous that they observe in the operation of the plant, machinery, tools or implements, in the appearance of the materials with which they are working or in the acts or conduct of other people. In experimental and development work and in trials it may become necessary to deal with shortcomings in equipment that have become apparent in the course of operations. In these circumstances independent competent assessment of the associated hazards may need to be sought. Ad-hoc procedures are to be discouraged and in their place a careful and considered approach to the problems must be fostered.

Provision of Shielding for Explosive Ordnance Work

1.68 Where it is practicable to do so, suitable shields or protective devices are to be provided, to protect personnel from the effects of an explosion.

1.69 **Shielding Specification.** The dimensions and strength of shields for use with EO is to be related to the magnitude of the explosion effects it may be called upon to withstand. Shields are to be type-tested where practicable. If it is not practicable to type-test a guard its design should be based on accepted safety criteria of a tested shield. It is important to ensure that all shields are adequately secured so that in the event of an explosion they are not projected against the person they are intended to protect. The amount of EO allowed behind a type-tested shield is to be marked upon it together with a reference to the record of its design or type testing trial. Defence Explosive Ordnance Logistics Capability (DEOLC) Explosive Ordnance Licensing Authority (EOLA) is to be consulted in all cases of doubt as to the suitability of a shield, or where it has not been specifically type tested.

Action in Emergency

1.70 Personnel are to be made familiar with the action to be taken in an emergency such as explosion, fire or injury. Instructions to this effect are to be made known to personnel and steps taken to ensure that they understand them (see Regulation 4.7 Procedure 1 and Manual Fire Protection Engineering (MFPE)).

Medical Approval

1.71 Only personnel who have been medically approved for the work are to be allowed to work with substances carrying toxic risks. Precautions appropriate to the hazards of the task must be taken. Where necessary, suitable extraction plant is to be provided, as it is better to remove the hazard where this is practicable than to attempt to protect the individual (see also Regulation 4.6 Procedure 1).

Protective Clothing for Explosives Ordnance Work

1.72 When carrying out work with EO, special protective clothing, headwear and footwear, are to be worn as required. The area in which such protection is worn and by whom, is to be laid down by the OIC of the establishment who is also to define any limitations on private clothing or uniforms worn in conjunction with the special protective clothing and equipment (see also Regulation 4.6 Procedure 1). Suitable arrangements are to be made for the laundering of protective clothing used with EO.

Restrictions on Movement of Personnel Between Facilities

1.73 Toxic and other hazardous materials, including those liable to cause dermatitis, are to be limited to the area where they are handled. To do this it may be necessary to limit the movement of persons whose protective clothing may be contaminated. Suitable decontamination procedures are to be developed locally.

Medical Aids and Appliances

1.74 It is desirable to avoid the carrying or wearing of metal or other hard objects, or anything that may shed fragments and introduce a hazard to EO processes. Medical aids and appliances such as spectacles, trusses, etc should also be considered so that they do not introduce a hazard into the work being done. Hearing and other aids to body functions which are electrically operated are to be approved by DEOLC (EOLA).

SAFE PROCESSING OF EXPLOSIVES AND EXPLOSIVE ORDNANCE

Cleanliness in Explosive Ordnance Buildings

1.75 Arrangements are to be made to minimise the entry of mud, grit, etc into buildings used for EO. This may require personnel to enter a building or a section of a building through a facility where footwear is changed.

Entry to Clean Areas

1.76 Entry to areas where 'clean conditions' exist is to be across a barrier, appropriately marked and sited. Special footwear is to be provided for use on the clean side. Regulation 4.4 Procedure 6 details the special requirements for operating facilities under 'clean conditions'.

Explosive Ordnance Storehouse Conditions

1.77 Where EO storehouse conditions apply, special footwear is not necessary as it is for magazines. Cleanliness, however, is still required and, where required, mats are to be placed outside EO storehouses and footwear wiped before entering such a building.

Cleanliness of Benches, Fittings and Floors

1.78 Floors, interior benches and fittings are to be maintained in a clean condition.

Care with Flammable Materials

1.79 Cotton rags, paints, solvents used for cleaning and other flammable materials are only taken into an EO building in minimum quantities for immediate use. All material remaining after use is to be removed to suitable flameproof metal cupboards outside the building or other authorised storage places. Where flameproof metal cupboards are used they are to be sited away from the wall of the building and well clear of the door and any opening windows.

Segregation of Waste Explosives

1.80 Care is to be taken to ensure that waste explosive is always kept separate from other waste matter, and that separate containers appropriately marked are used for each type of explosive.

Explosives Contaminated Materials

1.81 Used cleaning materials and other articles of waste that may be contaminated with explosives, are to be treated as waste explosive and disposed of in accordance with instructions issued by the OIC of the establishment. They are to be kept separate from waste explosive material.

Disposal of Waste Material

1.82 All waste from EO buildings is to be appropriately identified and adequate arrangements are to be made for its safe collection and disposal.

Cotton Waste

1.83 Cotton waste presents a serious fire hazard because it is liable to spontaneous combustion. Its use in EO areas is to be avoided.

Tool Specification

1.84 Guidance on suitable materials for tools will be found in the appropriate Explosives Hazard Data Sheet (HDS). HDS provide chemical and physical characteristics of explosive substances and list the particular hazards and handling requirements. HDS are prepared by Weapons Systems Division in the Defence Science and Technology Organisation, for all explosive substances of Australian origin or for which insufficient data is available from the source country. HDS or equivalent documents, prepared by the appropriate National Authority, are usually available for explosives of overseas origin. Tools should be designed to give no more than the torque or force that is consistent with the requirement of the operation. Lengths of piping which could be used to increase the applied torque should be excluded from EO buildings or sites. Adjustable spanners are not normally to be allowed for EO work.

Building Explosives Limit

1.85 The explosives limit applicable to a particular building or area is to be displayed on the appropriate Explosives Limit Licence (ELL) (see Regulation 5.3 Procedure 1 for ELL requirements). In addition, for facilities storing small quantities the maximum amount and type of explosives, by name, actually permitted in an EO building may need to be posted in the building. This limit is to be fixed by OIC of the establishment and may be equal to or less than that approved by the Licensing Authority on the ELL. The aim should always be to keep the quantity of EO in a building to minimum rather than the limit posted.

Covering of Explosives

1.86 It is good practice for any explosive not being worked upon, or in process, to be kept covered or in its container and as far away as practicable from material being processed.

Explosive Ordnance Life

1.87 The life of EO is to be managed in accordance with Topic - 024 of the item publication.

Reviewing Explosive Ordnance Stock for Disposal

1.88 EO stocks are to be reviewed for disposal when they become surplus to requirements. Explosives that have been ordered for trials that have been completed or have been cancelled are similarly to be considered for disposal.

Shielding Explosive Substances from Direct Sunlight

1.89 Explosive substances are not to be exposed to direct sunlight. EO should not be exposed to direct sunlight for prolonged periods.

Spillage of Explosive Substances

1.90 The procedure for dealing with spillage of liquid or solid explosives is to be laid down and followed. The method to be used in clearing up a spillage of explosives will depend to some extent upon the circumstances in which the spillage has occurred. When a spillage can be tackled there is to be available a procedure for doing this promptly and safely. Where the personnel present or the circumstances of the spill preclude immediate action, the requirement to call qualified assistance is to be well established. There is to be an approved desensitising agent for an explosive used in an establishment. Adequate quantities of the appropriate agent are to be conveniently available. Because of the potentially hazardous nature of many explosives it is most important to prevent operatives from taking unauthorised action in clearing up spillages. During clearance of spilled explosives, only the minimum number of people are to be present. Unless the explosive is highly sensitive it is advisable to pick it up either alone or with some diluent such as sawdust, if this is compatible, and take it to an approved place for reworking or preferably for disposal. There is always some hazard present in clearing up a spillage of explosives and in the case of very sensitive explosives it is often advisable to chemically destroy the bulk of the explosive where it has fallen and then clear up the reaction products.

Breaking Down of Explosive Ordnance and Non-Explosive Dangerous Goods

1.91 Work involving the breaking down of EO and Non-Explosive Dangerous Goods is potentially more hazardous than, and is to be segregated from, any other work. Additional precautions are therefore necessary, and EO is not to be broken down where no positive gain will result (see Regulation 2.4).

Equipment Trials

1.92 EO establishments may be called upon to carry out or to assist in trials with new EO packaging, handling and movement techniques or to conduct trials on new breakdown, disposal, repair or proof processes. In such instances, the normal safety precautions detailed in this manual are to be observed unless any deviations are specifically authorised.

Estate Management Plan

1.93 A balanced plan of estate management is to be implemented to reduce the risk of fire and erosion. The fire hazard may be reduced by the installation of firebreaks and the control of vegetation, but care is required to ensure that the firebreaks do not cause soil degradation and erosion.

1.94 Vegetation may be controlled in a number of ways, one of which is grazing by introduced livestock. Traverses may need to be protected to avoid damage by the animals. The natural fauna (vermin) which is always present must also be controlled to avoid damage to buildings and installations. Regulation 4.5 Procedure 1 provides guidance on the creation of firebreaks and the control of vegetation, introduced livestock and vermin.

INSPECTION REQUIREMENTS FOR EXPLOSIVE ORDNANCE FACILITIES

Inspection of Explosive Ordnance Areas and Facilities

1.95 All EO areas and facilities are to be inspected periodically in accordance with Regulation 1.4.

Annexes:
A. Example of Explosive Ordnance Area/Facility Warning Notice
B. Articles Prohibited in an Explosive Ordnance Area

ANNEX A

EXAMPLE OF EXPLOSIVE ORDNANCE AREA/FACILITY WARNING NOTICE

CONDITIONS OF ENTRY

ENTRY TO A COMMONWEALTH EXPLOSIVES AREA OR EXPLOSIVES FACILITY IS SUBJECT TO THE APPROVAL OF THE OFFICER COMMANDING (OR COMMANDING OFFICER).

NO PERSON IS PERMITTED TO ENTER A COMMONWEALTH EXPLOSIVES AREA OR EXPLOSIVES FACILITY UNLESS AUTHORISED BY THE OFFICER COMMANDING (OR COMMANDING OFFICER) OR AN APPROVED DELEGATE.

ALL PERSONS EMPLOYED IN AN EXPLOSIVES AREA OR EXPLOSIVES FACILITY ARE TO BE CONVERSANT WITH THE GENERAL INSTRUCTIONS PRESCRIBED IN eDEOP 101 - DEPARTMENT OF DEFENCE EXPLOSIVE REGULATIONS REGULATION 4.4 PROCEDURE 1 AND THE FIRE WARNING SYMBOLS AND PRECAUTIONS DETAILED IN REGULATION 4.7 PROCEDURE 1

ANNEX B

ARTICLES PROHIBITED IN AN EXPLOSIVE ORDNANCE AREA

1. The following articles are to be prohibited from explosive ordnance areas or authorised and strictly controlled by the Officer-in-Charge of the establishment:

a. Oil or gas filled lighting, heating or burning appliances and all flame, spark or fire producing appliances.

b. Matches and other portable means of producing a spark or flame.

c. Radio transmitters and receivers, including mobile phones and pagers.

d. Cigarettes, tobacco in any form, and any article used for the purpose of smoking.

e. Beers, wines and alcoholic liquor.

f. Motor spirit, flammable oils and solvents not contained in the fuel tank of a vehicle or in a sealed container.

g. Firearms.

h. Drugs and medicines.

i. Food and drink unless for sale or consumption in official canteens or refreshment areas.

j. Battery operated equipment.

k. Radioactive material.

l. Cameras.

NOTE

This list is not comprehensive and may vary from site to site.

PROCEDURE 2 - EXPLOSIVE ORDNANCE STORAGE FACILITIES

Introduction

2.1 Explosive ordnance storage facilities comprise all buildings, open sites, lockers or other structures in which Explosive Ordnance (EO) may be stored, including Explosive Ordnance Storehouses (EOSH), magazines and underground storage areas.

Purpose

2.2 This instruction describes the administrative requirements for EO storage facilities, which are additional to the general requirements contained in Regulation 4.4 Procedure 1. Further special requirements for underground EO storage facilities and magazines are detailed in Regulation 4.4 Procedure 3 and 4 respectively, and for Small Quantity Facilities in Regulation 5.3.

Licensing

2.3 All EO storage facilities are to be licensed in accordance with the requirements of Regulation 5.2 Procedure 1. The requirements of Regulation 5.4 Annex A sub-paragraphs 143 (b) and (c) re period of operation in adjacent EOSH and non-permanent transfer facilities, are to be observed.

Explosives Content Board

2.4 An Explosives Content Board is required to record the Net Explosives Quantity (NEQ) stored in the storage facility at any given time. A typical layout of an Explosives Content Board (ECB) is given in Annex A. The board is to be located inside the facility, in the near vicinity of the doorway together with a copy of the Explosives Limit Licence. The Explosives Content Board is to be updated as movements of EO occur. The recording of explosives content is also available by electronic means, e.g. COMSARM, in many storage areas. However, since the update of the electronic data can significantly lag the real time storage situation and corporate governance requires that the explosive limits for EO buildings never be exceeded, the manual system provides facility management with real time assurance that the explosive limits are never breached. Accordingly, the requirement for Explosives Content Boards is mandatory for all EO storage facilities except for EO storage depots where alternative arrangements to achieve the intent of this requirement may be implemented, e.g. a print out of COMSARM screen WH07 – Explosive Quantity Enquiry, for each facility on the Depot, at the end of each day which is retained as part of the Depot Emergency Plan.

Personnel Limits

2.5 EO storage facilities are to have a Personnel Limit applied. The limit is to be displayed on the Explosives Content Board or on a suitable notice that is displayed adjacent to the Explosives Limit Licence (ELL) located in the facility. The limit is to be assessed on an individual site basis, and should reflect the minimum number of personnel necessary to allow EO operations to proceed smoothly and effectively in and around that site. The limit may be exclusive of transitory supervisory staff and authorised visitors but may need to include extra staff for stock relocation tasks, and personnel on estate management tasks or personnel from other units collecting EO.

Doors, Windows and Shutters

2.6 All doors, windows and shutters are to be kept closed and secured except when it is necessary to open them for work or ventilation.

2.7 Whenever work is undertaken in storage facility all doors are to be open to allow rapid evacuation in the event of an emergency. The only exception to this requirement is if pedestrian doors fitted with quick release push bars are located at the front and rear of the building. In this case, other doors need not be opened, provided that the quick release mechanism has been checked and found serviceable. When the doors are open, a responsible person is to be left in charge of the building.

2.8 When diesel powered Mechanical Handling Equipment (MHE) is in use inside an EO storage facility, doors and windows are to be open as required to prevent build up of a hazardous concentration of exhaust fumes.

Disconnection of Electricity Supplies

2.9 When an EO storage facility is vacated, the electricity supply is normally to be disconnected by switching off at the master switch. In buildings where a constant temperature and/or humidity is required, the power supply for the conditioning units and control systems may be left on, but the power supplies to all other services in the building are to be disconnected. Power required for security purposes must remain connected.

Unauthorised Explosive Ordnance and Tools

2.10 No person, without the special authority of the Officer–in–Charge (OIC) is to take any chemical, explosive substance or explosive store into an EO storage facility except such as are authorised for use or storage therein (see also Regulation 4.4 Procedure 1, Annex B). Tools required for carrying out repairs to buildings are to be authorised by the OIC, in accordance with Regulation 4.5 Procedure 2.

2.11 Cleaning equipment, e.g. brooms/sweepers, doormats, dustpans and brushes and handling trolleys, required for day–to–day housekeeping of facilities, may be stored therein.

2.12 Tools and materials required for use during permitted operations (see paragraph 2.13-2.15) must be authorised in writing by the OIC before being taken into any EO storage facility. All approved tools are to be appropriately stored away when not in use. Tools and materials must be removed from the facility at the end of each day and/or on completion of the authorised tasks. Banding cutters may be kept in the storage facility to allow access to any suspect EO.

Permitted Operations in EOSH

2.13 Work permitted on EO in EOSH is limited to banding, stencilling, labelling, desiccant renewal and re-palletisation where the EO container is not opened. When it is necessary to carry out other work e.g. cleaning or scraping of containers, or opening the containers, they are to be removed to an EO workshop. These limitations do not apply to EO of Hazard Classification Code (HCC) 1.4S – see paragraph 2.15 for details. No other EO (other than unboxed shells, bombs and the like) is to be exposed in the storehouse.

2.14 For the purpose of conducting a monitoring audit, authorised inspectors may open ‘closed’ and ‘fraction’ containers to verify and validate contents as required by Regulation 1.4 Procedure 3, provided that the individual package is removed to the exterior of the EOSH and the access door is closed prior to opening the container. EO requiring periodic venting (to release built up gas pressure) must be removed to the exterior of the EOSH and the access door closed prior to unpacking, venting and repack operations.

2.15 **Opening of Packages of HCC 1.4S.** Packages containing EO of HCC 1.4S may be opened inside an EOSH under the following conditions:

a. Outer packages may be opened to remove sealed inner packs e.g. BAW F3 opened to remove BAM M19A1.

b. Provided a separate compartment or suitably traversed area is available within the EOSH for the task, and the EOSH is licensed for the storage of HCC 1.4S SAA only, monitoring audits, other EO inspections, EO accounting and EO repack operations may be conducted within the EOSH.

c. Anybuilding utilised in accordance with paragraph 2.15 b can only be used if approved for such activity on the explosive limit licence and may be classified as a Group 2 exposed site to another potential explosion site.

2.16 Non–explosive dangerous goods may be visually inspected in a storehouse authorised for dangerous goods storage only, but if for any reason they are taken into an EO workshop, they are to be treated as Hazard Division 1.3 EO except when otherwise indicated.

Cleanliness

2.17 Before taking any EOSH into use it is to be thoroughly clean and while in use, is to be kept clean. Where required, doormats are to be provided at each entrance; the floor and all platforms and fittings are to be kept free from dust and grit. Oiled rags, waste and other articles liable to spontaneous combustion are to be placed immediately after use, together with any other refuse, into metal bins provided with lids, situated outside the building. These bins are to be cleared at regular intervals and on no account are they to remain filled overnight. As soon as a building has been emptied, it is to be thoroughly cleaned.

Examination of Packages and Unboxed EO

2.18 Before admission into an EO storage facility, every package and unboxed item of EO is to be examined to ascertain that it is undamaged, correctly marked and sealed, properly closed or plugged and externally clean. If the seal of a package is broken or missing, the inner packages/contents are to be examined and, if found satisfactory, the package is to be correctly sealed before admission into the storage facility. This examination of EO is to take place in an EO workshop or in accordance with paragraph 2.15 b. Defective or incorrectly marked packages are to be repaired/replaced and correctly marked before admission or segregated and placed under local restriction pending rectification.

Maintenance of Stocks

2.19 Stockholders and/or Custodians are responsible for ensuring that all stocks of EO in their charge are correctly maintained and that the particulars of identification are not allowed to become illegible, nor exposed metal parts allowed to corrode.

Storage of Empty Packages and Pallets

2.20 Unless specifically authorised in writing by the OIC of the establishment, empty packages are not to be stored in EO storage facilities with EO. When necessary, they may be stored within the EO area in a place set aside for the purpose (see Regulation 5.4 Annex A paragraph 86 and Regulation 2.3 Procedure 5). Pallets are to be removed as soon as they have been emptied.

Aprons and Hard-Stand Areas

2.21 Aprons of EO storage facilities, used for loading and unloading vehicles, are to be smooth and level. They are to be maintained in a serviceable condition, any damage or subsidence being repaired as a matter of urgency to avoid jeopardising the stability of MHE loading or unloading EO. Aprons are to be swept regularly to avoid dirt or grit being tracked into the storage facility on tyres or shoes.

2.22 Hard-stand areas should be provided where necessary to allow off road parking for vehicles waiting to load or unload and the hard-stand areas should be sealed and level.

Ready-For-Use Storage

2.23 When EO is fuzed and/or made ready for use and is not required for immediate use, e.g. prior to ordnance loading operations for aircraft, the EO or the packages or dispensers in which it is contained are to be clearly marked to indicate its physical status, e.g. ‘fuzed’. Such prepared/ready- for-use EO is to be segregated in storage.

Annex:
A. Typical Layout of an Explosive Content Board

ANNEX A

TYPICAL LAYOUT OF AN EXPLOSIVE CONTENT BOARD

<table>
<tr><th colspan="3">EXPLOSIVE CONTENTS BOARD</th></tr>
<tr><td colspan="3">EXPLOSIVE ORDNANCE STOREHOUSE (BUILDING No. ____________________)</td></tr>
<tr><td>HAZARD DIVISION</td><td>EXPLOSIVE LIMITS
(per Explosive Limit Licence)</td><td>CURRENT NEQ (kg)</td></tr>
<tr><td>1.1</td><td></td><td></td></tr>
<tr><td>1.2.1</td><td></td><td></td></tr>
<tr><td>1.2.2</td><td></td><td></td></tr>
<tr><td>1.3.3</td><td></td><td></td></tr>
<tr><td>1.3.4</td><td></td><td></td></tr>
<tr><td>1.4</td><td></td><td></td></tr>
<tr><td colspan="2">MIXED HAZARD DIVISIONS CURRENTLY STORED
AGGREGATED AS HD ____________________</td><td></td></tr>
<tr><td colspan="2">COMPATIBILITY GROUPS STORED</td><td></td></tr>
<tr><td colspan="2">PERSONNEL LIMIT</td><td></td></tr>
</table>

PROCEDURE 3 - UNDERGROUND STORAGE AREAS

General

3.1 Underground explosives storage facilities utilise special requirements for operation. These requirements are in addition to those requirements contained in Procedures 1 and 2 of Regulation 4.4.

Special Requirements

3.2 Special requirements for operations in an underground storage areas are contained in Part 3 of Allied Ammunition Storage and Transport Publication – 1 (AASTP-1 May 2010[1]).

[1] The continued use of AASTP 1: 2010 is under review

PROCEDURE 4 - EXPLOSIVE ORDNANCE MAGAZINES

Introduction

4.1 Magazines are Explosive Ordnance (EO) storage facilities in which 'clean conditions', described in Regulation 4.4 Procedure 6 are required to be maintained.

Purpose

4.2 This instruction prescribes the special requirements for magazines. The general requirements applying to EO areas and storage facilities contained in Regulation 4.4 Procedure 1 and 2 are also applicable to the administration of magazines, except that no inspection or maintenance operations are permitted within magazines.

Magazine Conditions

4.3 In addition to the requirements referred to in paragraph 4.2, the following rules (known as 'Magazine Conditions') are to be observed in the operation of magazines.

4.4 Admittance within the barrier of a magazine is confined to those on duty therein. Before entering, all persons are to search their pockets to ensure the absence of prohibited articles.

4.5 All persons entering a magazine are to observe the rules governing the maintenance of 'clean conditions' (see Regulation 4.4 Procedure 6).

4.6 All persons employed in magazines may be searched at the barrier by the person in charge, and visitors are to accept liability to be searched. All persons entering are to be challenged as to their freedom from prohibited articles by the person in charge of the magazine, who is to specify the prohibited articles.

4.7 Cleanliness is of vital importance in magazines. Cleaning implements, which are to be made of non-ferrous metal, are to be kept to a minimum. The wheels and fittings of all trucks used in magazines are to be of copper or copper alloy. All floors and platforms are to be cleaned frequently. Fittings are to be kept free from dust or grit.

Special Clothing

4.8 All persons entering a magazine are to put on the special clothing and shoes as prescribed in Regulation 4.4 Procedure 6.

PROCEDURE 5 - EXPLOSIVE ORDNANCE WORKSHOPS

Introduction

5.1 Any building or area in which the processing, (ie inspection, breakdown, modification, assembly, testing and maintenance) of Explosive Ordnance (EO) and Non-Explosive Dangerous Goods (NEDG) takes place, other than those operations which are permitted in EO storehouses is an EO workshop. This includes buildings or areas with equipment for specific EO tasks, eg painting, sealing, etc, and laboratories used for the development, research and/or testing of EO substances.

5.2 Facilities at user units used for the preparation of EO need not be administered as EO workshops, but as EO Preparation Facilities (see Regulation 4.4 Procedure 7).

Purpose

5.3 This procedure prescribes the administrative requirements for the management and safe operation of EO workshops, and is to be read in conjunction with Regulation 4.4 Procedure 1.

Integrated weapon facilities and guided weapon workshops

5.4 The special requirements applicable to Integrated Weapon Facilities and Guided Weapon Workshops are detailed in Regulation 4.4 Procedure 8 and are additional to the requirements of this instruction.

Types of explosive ordnance workshops

5.5 EO Workshops are graded in accordance with their construction and the facilities they provide. Broadly, these grades are:

a. **Grade A.** A permanent workshop constructed as such and completely equipped to permit the inspection and maintenance of all natures of EO.

b. **Grade B.** A workshop, either constructed as such or adapted, with less equipment than a Grade A workshop, in which most inspection and maintenance operations can be done.

c. **Grade C.** A building or area without special equipment, taken into use for the inspection and maintenance of EO.

5.6 The constructional requirements for these various grades of workshops are contained in Regulation 6.1 Procedure 1.

Conditions for workshop operations

5.7 The conditions under which maintenance and inspection operations are to be done, vary with the type of the EO and the precise nature of the work. Four classes of conditions are prescribed, namely:

a. **Class 1.** Clean conditions with restricted humidity.

b. **Class 2.** Restricted humidity.

c. **Class 3.** Clean conditions.

d. **Class 4.** Normal conditions as specified in this procedure.

5.8 The requirements for clean conditions and restricted humidity conditions are fully described in Regulation 4.4 Procedure 6 and Regulation 4.1 Procedure 6 respectively.

5.9 The class of conditions required for each type of EO is to be indicated in relevant maintenance instructions (eg TIAD/DMPI/IRI).

Functional components of explosive ordnance workshops

5.10 EO workshops may be comprised of a number of workrooms, preparation-rooms and waiting/transit areas. The essential features of workrooms, preparation-rooms and waiting/transit areas are:

a. **Workrooms.** Workrooms in an EO workshop are compartments of the building separated from other compartments by walls of substantial construction, eg brick or reinforced concrete, not less than 230mm thick and which are without direct communicating doors between compartments. Workrooms may or may not be effectively traversed from other work or preparation rooms and waiting/transit areas. Workrooms are used for the inspection, maintenance and testing of EO.

b. **Preparation rooms.** Preparation rooms in a workshop are used for the receipt, unpacking, repacking and dispatch of EO. The necessary stencilling of stores or packages is permitted within preparation rooms.

c. Waiting/transit areas.

(1) Waiting/transit areas associated with EO workshops are sites used for the temporary holding of EO which is to be processed through the particular workshop, or as an assembly point to accumulate EO before return to storage.

(2) A waiting/transit area should normally be traversed. It may be sited within the traverse of the building/workroom it is intended to serve in which case it will share the approved explosives limit of the building/workroom, i.e. the combined Net Explosive Quantity (NEQ) of the explosives within the building/work-room and the waiting area must not exceed the licensed limit for the building/workroom as a whole.

(3) Boundaries of waiting/transit areas must be marked out and EO in these waiting positions must always be within these bounds.

Licensing

5.11 EO Workshops are to be licensed in accordance with the requirements of Regulation 5.2 Procedure 1. Explosives limits must be assigned to the workshop as a whole and separate limits for each room and waiting position may be assigned depending upon the traversing arrangements between rooms and waiting positions.

5.12 In assessing the explosives limit for each room the following explosives quantities are to be taken into account:

a. Traversed rooms: all explosives within the traverse.

b. Untraversed rooms: all explosives in the building and waiting area in the near vicinity, unless the waiting area is separately traversed.

Instructions for explosive ordnance workshop operations

5.13 No work of any kind is to be undertaken in EO workshops unless details of the procedure for each operation and the tools authorised for the work are given in maintenance instructions or other authorised instructions. The only exceptions are as follows:

a. Explosives operations conducted in Guided Weapon Workshops and Integrated Weapon Facilities in which operations are detailed in locally prepared safety and operating instructions and weapon processing instructions (See Regulation 4.4 Procedure 8).

b. Explosives operations conducted in EO Workshops or EO Preparation Facilities (see Regulation 4.4 Procedure 7) at user establishments where operations are to be done in accordance with relevant EO preparation procedures amplified by local instructions.

c. The proving of draft maintenance instructions by staff specifically authorised to undertake such operations.

5.14 Operatives and supervisors undertaking any explosives work are to ensure that they have maintenance instructions or weapon processing instructions and other safety instructions as appropriate, and any other data they may require, eg Materials Safety Data Sheets, available at the work site. The instructions are to be constantly referred to by the operatives and supervisors to ensure correct processing and the safety of themselves and that of other operatives nearby. At the start of any task and at the start of work each day all operatives are to be briefed by the workshop supervisor as to the risks associated with the task as a whole and the particular risks arising from their individual operations.

5.15 **Workshop diary ammunition processing facility.** A workshop diary is to be maintained and the supervisor is to record:

a. Work task activities along with staff briefings performed in the workshop on the day;

b. The names of individual's working and visiting the workshop during the day; and

c. Details of any unusual incidents, including accidents, security breaches, emergencies/emergency drills, fires etc.

The diary is to be hard bound in year order and retained by the facility. Diaries are to be stored in a fire proof cabinet when not in use.

5.16 **Display of work authorisation.** An Explosives Work Authorisation Board is to be displayed in each EO workshop room. A typical design is shown in Annex A. As a minimum, the information to be displayed on the board is the building number, the name of the person in charge of the activity, the number of operatives approved for the activity, the name, NEQ and number of each EO item required for the activity and the total NEQ in the building, and the fire and supplementary fire symbols to be displayed. Any special safety instructions, including the required class of workshop operating conditions, are also to be displayed. The details called for on the board must be filled in by the senior maintainer or workshop supervisor at the commencement of each new job. Where convenient for effective management of explosive limits, it is permissible to use Form EO077 –Authorised Use and Explosives Content of An Explosives Facility (see Regulation 5.3 Procedure 1, Annex B) to record the actual NEQ in an EO workshop. When so used, the words 'Small Quantity' are to be erased from the EO077 title. Explosive Limit Licence details are to be taken from the EO workshop licence. The Form EO077 is to be displayed on the Explosives Work Authorisation Board during the work activity.

Articles in use

5.17 All approved tools, appliances and consumables required for each operation in an EO workshop are to be listed in the relevant Maintenance Instructions or other authorised instructions for that particular operation. Any items, including empty packages if not so listed, should be removed from the workroom in which the particular work will be undertaken.

5.18 **Soldering irons.** Soldering irons are to be used only in workshops in which Class 2 or Class 4 operations are being done, unless an entirely separate room is provided without direct access from the clean area. Electric soldering irons may not be used in Explosive Hazardous Areas. They are to be used only in accordance with the operating instructions or clearance rules of the facility. Since it is not practicable to restrict the surface temperature, the following conditions must be observed:

a. Solder is to be carried out only at a designated working position away from the bulk of the ammunition in the building and where no other work on explosives is being done;

b. The bench top must be of non-combustible material and a suitable fire-proof storage space is to be provided to accommodate the hot iron;

c. The size and rating of the iron must be as small as practicable and consistent with the task to be carried out; and

d. Each electric iron must be connected to a separate wall mounted double pole switched socket outlet which will ensure complete isolation and which is provided with pilot lamp indication.

5.19 **Tools and apparatus.** The special requirements applicable to the handling and use of tools and apparatus in EO workshops are detailed in Annex B.

Non-explosives in workshops

5.20 When a workshop contains EO, and whether it is being worked upon or not, the introduction of non-explosive items (other than essential tools, gauges, etc, authorised under paragraph 5.16 above) into the workshop, is prohibited. Exceptionally, non-explosive components which are integral parts of EO for storage purposes, eg the plug which replaces the fuze in a projectile, may be inspected simultaneously with the store itself, provided the inspection operations for the non-explosive items do not necessitate the use of tools or equipment which are not permitted in the workshop during the inspection of the EO concerned.

Floors

5.21 Floors of rooms in which an explosive substance is, or is likely to be, laid bare, normally are to be of concrete and surfaced with an approved gritless covering, or alternatively, are to be permanently covered with a well-fitted linoleum type covering. When handling Electro-Explosive Devices (EED) and certain explosive substances, precautions are to be taken against the development of static electricity. These explosives are listed in Regulation 6.3 Procedure 2 Annex A. Floors of other workshops may be of concrete, suitably rendered to make them dustless.

5.22 Floor coverings and other anti-static protection systems to be incorporated into facilities in which EED are to be inspected, tested or handled in any way, are to be in accordance with the requirements of Regulation 6.3 Procedure 2.

Work benches

5.23 Workbenches in all EO workshops are normally to be covered with linoleum or non–ferrous metal. At depots, to enable the inspection and testing of EED and inspection of explosive substances or stores which involve the exposure of explosive substances, at least one workshop is to be equipped with:

a. A metal bench with a non–ferrous metal top, or

b. A hardwood bench with a non–ferrous metal top, or

c. A hardwood bench with a conducting grade rubber top laid over an earthed surface.

These benches are to be bonded directly to the building earth. During maintenance operations all tools and gauges, when not in use, are to be placed in contact with the earthed surface of the bench. At those establishments where inspection is infrequent, temporary arrangements are to be made to meet these requirements.

Layout of work

5.24 Benches on which explosives will be exposed are to be sited so that nothing can fall accidentally onto the explosive items. Care must also be taken to ensure that explosive items cannot accidentally roll off work benches.

5.25 Work is to be arranged so that explosive substances are never exposed to the direct rays of the sun.

5.26 Explosives not under operation must always be kept covered, either in their packages or under suitable fireproofed covers.

Hazardous chemicals

5.27 **Storage of chemicals in workshops**. Oils, spirits, paints, etc, necessarily present in a room are to be in serviceable containers, kept in a metal tray with sides adequate to contain spillage, and located apart from work benches. The quantity present is to be kept to a minimum. In silent hours all these materials are to be kept in a locked metal flameproof locker outside the room.

5.28 **Storage of chemicals in laboratories**. Hazardous chemicals stored in laboratories are to be stored in accordance with the Defence Safety Manual (SafetyMan) and in accordance with the laboratory licence and any accompanying restrictions/instructions. When stored in a laboratory, and the chemicals are to be located as far as reasonably practicable from explosives. Out of business hours, DG3 (Flammable Liquids) and DG8 (Corrosive Substances) are to be kept in a locked metal cabinet or cage consistent with SafetyMan. The requirement for hazardous chemicals to be stowed in cabinets or lockers during non-working hours is not applicable to hazardous chemicals in use as part of an EO process for extended periods of time.

Earthing points

5.29 Earthing points are to be provided in those workshops which do not meet the full anti-static requirements to permit inspection of explosive substances or of stores which involves the exposure of explosive substances or which contain EED (see Regulation 6.3 Procedure 2). Each person in such workshops is to be instructed in their use.

Protective screens

5.30 Protective screens, eg brick partitions or rope mantelets, inside workshops, are to be so positioned that access to escape doors is not impeded.

Doors and windows

5.31 While work is in progress, doors are not to be locked and exits are to be kept clear at all times. Windows are to be blast resistant, and should be fitted with blinds or shutters so that the direct rays of the sun do not fall on any exposed explosive substance.

Cleanliness

5.32 Workshops are to be kept clean at all times. Any spillage of an explosive substance, or dust therefrom, is to be swept up at once and deposited in a receptacle containing water or oil. This receptacle is to be emptied and cleaned daily, and every time the workshop is vacated receptacles containing oiled rags and other waste are to be removed from the workshop during the period that the building is not occupied. Before commencing a new operation, the workshop is to be cleaned and all traces of the previous operation removed. This is to be done by washing; the use of floor polishes is prohibited, unless recommended by the manufacturer of the flooring material - see also Regulation 6.3 Procedure 2.

5.33 **Work on dusty explosives.** Work on dusty explosives necessitates particular attention to cleanliness (see Regulation 4.4 Procedure 6).

5.34 **Dusting of surfaces.** Any surfaces, including radiator and steam pipes, on which dust might lodge must be dusted thoroughly at frequent intervals.

Employee working alone

5.35 No person should be permitted to work alone in EO workshop operations that involve EO, where another person cannot provide immediate assistance in case of an accident.

First aid apparatus and personal cleanliness

5.36 Each workshop is to have access to adequate first-aid apparatus, appropriate for the work to be done. Advice on the types and quantities of such apparatus is to be obtained from the responsible medical authority. Personal cleanliness is essential, with frequent washing of the hands and face to avoid the toxic effects of contact with explosives; barrier creams, protective clothing etc, are to be used to restrict skin exposure to contaminants.

Protective clothing

5.37 Special protective clothing is to be worn in EO Workshops, see Regulation 4.4 Procedure 6 and Regulation 4.6 Procedure 1. Rules governing the wearing and maintenance of such clothing are specified in Regulation 4.4 Procedure 6.

Protective measures

5.38 When EED are being inspected and tested, the provisions of Regulation 4.4 Procedure 7 applying to work on EED are to be observed.

Hygrometric conditions

5.39 **Permissible limits of relative humidity.** Certain explosives are hygroscopic and the exposure of such substances is to occur only when the conditions are favourable, the normal working limit being based on a standard of 80 per cent relative humidity at 16º C (60ºF). Any inspection operation which requires restricted humidity conditions is indicated in the relevant Maintenance Instructions. The method of determining the relative humidity is detailed in Regulation 4.1 Procedure 6.

5.40 **Precautions against condensation.** EO brought from cold environments is to be allowed to adjust to workshop temperature before explosives are exposed in order to avoid condensation on the filling. If condensation is visible on the store or package, work is not to proceed until the condensate has evaporated.

Drying of items

5.41 Non-explosive components for filling, assembly, and packing must be dried thoroughly in accordance with the appropriate Maintenance Instructions.

5.42 EO is not permitted in buildings in which drying ovens are fitted.

Temperature limits

5.43 Certain EO is not to be worked upon when the temperatures within a workshop are abnormally high or low. These temperature restrictions are detailed in Regulation 4.1 Procedure 4.

Distribution of stores, benches, etc

5.44 The stores within the workshop are, as far as possible, to be equally distributed throughout the work-rooms, and not more than half the floor area of these rooms is to be occupied by benches or stores which are to be so positioned that each person has free access to one or more of the exits provided. In the event of a runway system (eg gravity roller) masking an exit, the runway is to be hinged at this point and marked distinctively to denote that the exit is not permanently impeded. The side of the length of runway concerned is to be painted bright red and marked in white 'LIFT FROM THIS END' indicating the unhinged end with an arrow also painted in white.

Entrance into a workshop

5.45 All persons, other than visitors, supervisory and managerial staff, employed in a workshop which is being operated under 'clean conditions' (see Regulation 4.4 Procedure 6) are, before entering, to exchange their outer garments for the special clothing provided, including conducting shoes where conducting or anti-static precautions are to be observed. This exchange of clothing is to be effected in the shifting lobby of the workshop in which instructions for entering and leaving clean areas are to be displayed. Supervisory, managerial staff and visitors are to enter the workshop in the manner detailed in Regulation 4.4 Procedure 6.

5.46 Persons employed in workshops not under 'clean conditions' are required to wear protective clothing as detailed in Regulation 4.6 Procedure 1.

Search on entering and leaving a workshop operated under 'clean conditions'

5.47 Before entering the 'clean' area of a workshop, all persons are to search themselves to ensure that they are free from ferrous or other prohibited articles. Any prohibited article found is to be deposited on the 'dirty' side of the shifting lobby. All persons passing the barrier to the 'Clean' side are to be challenged as to their freedom from prohibited articles. Persons employed in the workshop are subject to challenge by the person in charge when entering or leaving, and at any time whilst in the workshop. Visitors and supervisors may be challenged if it is considered necessary by the person in charge. Additional requirements for clean areas given in Regulation 4.4 Procedure 6 are to be observed.

Daily operating routines

5.48 **Handling.** EO is to be handled and moved with care at all times and exposure to direct sunlight is to be avoided, particularly in the case of unpacked or exposed items. Movement is to be under control at all times. Action is to be taken to ensure that EO cannot fall from benches, trolleys, cradles, conveyor or handling systems. Benches on which explosives will be exposed are to be positioned so that nothing can fall accidentally onto the explosive items. Explosives not under operation must always be, either in their packages or under suitable covers.

5.49 **Temporary work breaks.** During temporary breaks in the working day, EO may be left in position provided that the following is observed:

a. Unpackaged EO is safely stowed, or

b. EO is packaged in its approved service pack, and

c. No bulk explosives or explosive filling is exposed.

5.50 **End of day.** EO in workshops at the end of a working day is to be dealt with as follows, subject to both overriding security requirements and the discretion of the workshop supervisor:

a. When the next day is a working day, EO may remain in the working or waiting area or approved storage providing it is packaged and earthed; or

b. When the next day is not a working day, or the first day of an extended break, EO may only be left in waiting areas correctly packaged and earthed.

5.51 **Closing of workshops.** At the close of work, or when otherwise instructed, eg at the approach of a thunderstorm, all exposed explosives are either to be covered or placed into receptacles which are to be closed, all doors and windows are to be shut and secured, the electric current is to be switched off and any other heating devices turned off. Where electricity is required to power air-conditioning or other equipment the power may be left on.

Australian standards applicable to explosive ordnance workshops

5.52 Australian Standards (which may be) applicable to operations in EO workshops are detailed in Annex C.

DETERMINATION OF PERSONNEL AND EXPLOSIVES LIMITS

Purpose of personnel and explosives limits

5.53 The purpose of Personnel and Explosives Limits is to regulate, within the maximum net quantity of explosives permitted in each building, the amount of explosive which may be held in each room in relation to its size, the number of persons employed therein and the nature of the work required to be carried out. In the interests of safety, the quantity of explosive and the number of personnel are to be limited to the minimum possible to ensure the economical and effective functioning of the workshop; however, economic considerations should not normally compromise safety requirements.

Basis for personnel and explosives limits

5.54 Personnel and Explosives Limits are to be based on the authorised maximum NEQ and the Hazard Classification Code (HCC) of the items in the workshop. Due recognition is to be given to the changes in Hazard Division (HD) risks which may result when EO is unpackaged. Some examples are:

a. Shell and mortar bombs filled with HE which belong to HD 1.2 when packaged, may present a HD1.1 type risk when unpacked.

b. EO belonging to HCC 1.4S when packaged, cannot remain in Compatibility Group S and may even give effects similar to HD 1.2 or HD 1.3 items, when unpackaged.

Maximum net explosives quantity

5.55 The guiding principle to be applied when assessing explosive limits is to limit the explosives quantity to the minimum compatible with efficiency, but the maximum net explosives quantity of a building in use as a workshop is not normally to exceed 1 200 kg NEQ. This limit may be increased at the discretion of the Licensing Authority to a maximum of 10 000 kg. A building for this purpose is the whole of the space under one roof or a defined area in the open, including waiting positions, loading and unloading platforms and sidings, or roads, immediately adjacent to the building. Filled wagons or road vehicles are not to be parked on other roads or railways within the Process Building Distance, except for the purpose of loading/unloading.

Working limits - quantity of items

5.56 Notwithstanding that the maximum net explosives quantity for each room in a workshop is controlled, the maximum quantity of items permitted to be under operation in a room, ie items removed from their approved package/unit load, is to be determined locally for each particular operation based on the minimum number of items consistent with efficient working.

5.57 The maximum quantity of items permitted to be under operation is to be displayed on the Explosives Work Authorisation Board or Form EO077 (see paragraph 5.15). The total explosives content of this allowed quantity of items, together with that of any components accumulated in the room, must not exceed the explosives limit for the room.

Mixing of compatibility groups and hazard divisions

5.58 Mixing of explosives of different Hazard Divisions and Compatibility Groups in EO workshop buildings/rooms and at waiting positions is frequently necessary for the work in hand. Refer to Regulation 4.2 for the mixing of Compatibility Groups and Hazard Divisions.

Combination of operations

5.59 It is important that EO operations are carried out strictly in the sequence laid down in maintenance instructions or other approved processing documents. Work in any workroom is to be restricted at any time to one type of item.

5.60 In the event of operations needing to be combined, eg examination and repair, unplugging and fuzing, repair and testing, these are to be specifically called for in the task authorisation documents.

5.61 Concurrent work on items of dissimilar nature in the same workroom is not normally to be permitted.

Personnel limit

5.62 The number of persons permitted to be engaged at one time in a room is to be kept to the minimum consistent with effective working. The personnel limit for a room need not include inspectors and supervisors as long as they are not present for more than 1 hour per normal working day.

5.63 Occasional visitors, over and above the authorised number of personnel, may have entry and remain while work is in progress; but on such occasions, the number of visitors at a time and the periods of stay are to be limited to the minimum necessary to achieve the purpose of the visit. Admission of visitors to an EO workshop is at the discretion of the foreman or supervisor of the workshop.

5.64 As a whole, the EO workshop building must normally be regarded as a mass risk. Hence, the number of staff permanently engaged in parts of the building other than the licensed work and preparation-rooms are to be kept as low as is practicable. This principle also applies to transport and handling personnel.

5.65 The authorised maximum number of personnel permitted in any room is to be displayed on the Explosives Work Authorisation Board in the room.

Annexes:
A. Typical Layout of an Explosive Work Authorisation Board
B. Tools and Apparatus for Use in Explosive Ordnance Workshops
C. Australian Standards Applicable to Explosive Ordnance Workshops

ANNEX A

TYPICAL LAYOUT OF AN EXPLOSIVE WORK AUTHORISATION BOARD

EXPLOSIVES WORK AUTHORISATION BOARD						
BUILDING No:						
PERSON IN CHARGE: OPERATIVES:						
STORE:			NSN/ASN:			
OPERATION:						
WORK REQ NO:			VALID TO:			
HCC:			SUP SYMBOL:			
NEQ OF EACH STORE: kg			QTY IN BUILDING:			
MAX. QTY. OF ITEMS PERMITTED TO BE UNDER OPERATION:						
APPROVED LIMITS:						
Hazard Division	1.1	1.2.1	1.2.2	1.3.3	1.3.4	1.4
Personnel (No)						
Licence (Kg)						
ACTUAL NEQ IN BUILDINGS:						
Amount (Kg)						
SPECIAL INSTRUCTIONS: CLASS OF WORKSHOP OPERATING CONDITIONS:						

Figure 5A-1 Typical Layout of an Explosive Work Authorisation Board

ANNEX B

TOOLS AND APPARATUS FOR USE IN EXPLOSIVE ORDNANCE WORKSHOPS

Design and Approval

1. The chief engineers at the Explosive Materiel Branch (EMB) is to establish, in writing, an authorised process for the design, approval, repair, modification and control of tools and apparatus used in explosive ordnance workshops. Complete sets of drawings are to be maintained and kept up to date for all special tools and apparatus held.

Use of Correct Tools and Apparatus

2. Only tools and apparatus to approved designs and materials are to be used in work on Explosive Ordnance (EO), non-explosive dangerous goods and items suspected of containing explosives or dangerous fillings.

3. The tools required for each operation are specified in maintenance documents and the tools and apparatus provided for particular EO or operations are not to be used for any other purposes. Only tools authorised in relevant maintenance document may be taken into a workshop.

Ferrous and Aluminium Tools and Gauges

4. The use of steel or iron in the fabrication of tools is normally to be avoided, but they are not prohibited if the operation requires their use. The introduction of tools and gauges, etc, made of aluminium or aluminium alloy is prohibited.

Care and Maintenance

5. All tools and apparatus for use in EO workshops are to be kept serviceable. They are to be checked for serviceability on issue and periodically during use. Any defective tools are to be withdrawn from use immediately and replaced by serviceable items.

6. It is the responsibility of the custodian of gauges and other apparatus to ensure that items whose calibration life has expired are not issued for use.

Repair and Modification

7. If found necessary as a result of systematic inspection or other examination, repair and modification of tools or apparatus are to be carried out in accordance with approved drawings. If no approved drawings exist, prior approval is to be obtained from the authority nominated in the authorised process at paragraph 1 before repair or modification is undertaken.

8. After every repair or modification has been developed an officer, nominated in the authorised process at paragraph 1, is to check by examination and practical working that the equipment fulfils the purpose for which it was designed and that no interference with the working of any safety devices has resulted from the repair or modification.

Electric Leads and Connections

9. Electric leads and connections in electrical apparatus in EO workshops are to be kept in good condition and unauthorised connections are prohibited. See also Regulation 6.3 Procedure 1 for testing requirements.

Custody

10. Where not permanently installed or needed, equipment is to be drawn only when actually required and is to be cleaned and returned immediately on completion of work.

11. The person in charge of each room is to check the tools in the room before and after work each day and is to report discrepancies for immediate investigation.

Improper Use of Tools

12. Tools are only to be used as designed, eg unauthorised extension pieces must not be fitted to handles to obtain greater leverage. Abnormal force must not be applied to any tool.

13. Only light hand pressure is to be employed when gauging. This is most important both for reasons of safety and to prevent excessive gauge wear. Gauges are designed to accept correctly dimensioned items without the use of force.

Gauges

14. The gauges required for individual operations are listed in relevant maintenance instructions.

Management of Gauges

15. Policy on the management, control and calibration of mechanical gauges and measuring instruments, eg weighing scales, is detailed in Defence Logistics Manual Part 2 Volume 10 Chapter 19 – Calibration Policy for Support and Test Equipment (DEFLOGMAN Part 2 Volume 10 Chapter 19).

Maintenance of Gauges

16. Gauges are to be very carefully maintained and are to be protected against rust whilst not in use by lightly oiling or greasing. They are always to be handled carefully, since they are susceptible to damage. The working surfaces of a gauge are not to be cleaned with abrasive but should be rubbed clean with a cloth soaked with a solvent such as white spirit. If the working surfaces of a gauge become rusty, the gauge is not to be used but is to be transferred to the appropriate Gauge Management Authority for repair and re-calibration. Gauges are not to be adjusted or repaired locally.

17. Chamber gauges are to be turned daily when in use to equalise wear.

18. Ring and body gauges are to be stowed flat.

Checking of Gauges

19. It is the responsibility of the custodian of gauges to submit items for re-calibration when the calibration period expires, or when the accuracy of the gauge becomes suspect for any reason.

Weighing Appliances

20. Weighing appliances are to be maintained in good condition. They are to be checked periodically as laid down in paragraph 19.

21. The capacity of the scales selected is to be the nearest above the weight of the article to be weighed.

22. In order to eliminate the possibility of incorrect weighing, the procedure detailed in the relevant maintenance instruction is to be adhered to rigidly.

23. If any scales are found to be incorrect, the Officer-in-Charge of the establishment is to investigate and take appropriate follow-up action if the error may have affected the serviceability of any work carried out using the scales since they were last checked.

Checking of Electrical Test Apparatus

24. Policy for the design and repair, safety checking and calibration of electrical test equipment used in the processing of EO, are detailed in Regulation 6.3 Procedure 1.

ANNEX B

Explosive Dust-Extraction Equipment

25. Approved explosive dust-extraction equipment is to be maintained to the manufacturer's requirements. Such equipment is to be cleaned out regularly and the arising disposed of as explosive waste.

ANNEX C

AUSTRALIAN STANDARDS APPLICABLE TO EXPLOSIVE ORDNANCE WORKSHOPS

1. An indicative, but not necessarily exhaustive, list of Australian Standards which may be applicable to operations in explosive ordnance workshops are:

a. AS1324 - Air filters for Use in Air Conditioning and General Ventilation.

b. AS/NZS ISO 14644.5:2006 - Clean Rooms and associated controlled environments – Operations.

c. AS1386.5 - Clean Rooms and Clean Work Stations – Clean Workstations.

d. AS/NZS1680 - Codes of Practice for Interior Lighting and the Visual Environment.

e. AS2013 - Clean Room Garments.

f. AS2014 - Code of Practice for Clean Room Garments.

g. AS2268 - Electrostatic Paint and Powder Spray Guns for Explosive Atmospheres.

PROCEDURE 6 - CLEAN CONDITIONS

Introduction

6.1 The term 'Clean Conditions' is used to denote the conditions required to minimise the special risks attached to the storage of those explosives which are to be stored in magazines, and to reduce the possibility of accidents in Explosive Ordnance (EO) workshops in which Class 1 or Class 3 operations are undertaken (see Regulation 4.4 Procedure 5).

Purpose

6.2 This procedure details the special requirements for operating EO facilities under clean conditions.

General

6.3 Clean conditions apply to the special requirements to be observed in the construction and furnishing of the building, it's heating and lighting, the rigid control of cleanliness, entrance, exit, equipment, tools and operations, and the wearing of special clothing and footwear.

6.4 All explosives of Compatibility Group A, bulk explosives of Compatibility Group D and dusty explosives (see Notes), are to be held under clean conditions.

NOTES

Dusty explosives are those certain types of explosives which release fine dusts which are difficult to control. The only compounds and mixtures in service which fall into this category are gunpowder, Tetryl (CE) and exposed powdery pyrotechnic mixtures. When these explosives are exposed, Zone 21E electrical conditions may be required. All other explosives such as rocket motors and HE fillings may produce particles broken from the main charge, but, in general, the quantity is small and easily controlled. These explosives may require Zone 22E electrical conditions when they are exposed.

Items containing dusty explosives are normally adequately sealed and do not require clean conditions unless they are damaged or are to be broken down. Maintenance instructions governing work on this type of store are to specify whether clean conditions are required.

6.5 Particulars of the work to be done under clean conditions, and that the work must be done under clean conditions, must always be clearly specified in applicable maintenance instructions.

General Precautions

6.6 Before any EO or any package is taken into the clean area of a building, it is to be examined externally and any grit or objectionable substance is to be removed.

Tools and Equipment

6.7 Unless essential, the use of exposed iron or steel tools and equipment is to be avoided in buildings where clean conditions are to be observed. When this is unavoidable the relevant maintenance instructions are to state this requirement specifically.

Clothing and Footwear

6.8 The special clothing and footwear to be provided for persons employed in or visiting buildings under clean conditions, consists of:

a. Proban Coveralls, or shirts and trousers.

b. Dust Coat.

c. Conducting Shoes.

d. Overshoes and Legstats.

e. Plastic Disposable Gloves.

f. Proban Cap.

6.9 The items listed in paragraphs 6.8a, c and f are to be worn by persons employed in buildings operated under clean conditions.

6.10 The items listed in paragraphs 6.8b, c and f are to be worn by supervisory staff and visitors on entering a clean area. Alternatively, visitors may be provided with the items listed in paragraph 6.8d in lieu of those in paragraph 6.8c.

6.11 All personnel required to handle exposed explosive substances are also to wear the plastic gloves identified in paragraph 6.8e.

6.12 The special clothing and footwear identified at paragraph 6.8 is not to be worn outside the barrier of the shifting lobby (see paragraph 6.14), and if a person inadvertently steps from the 'clean' side, re-entrance is to be effected through the shifting lobby, ensuring that the shoes are properly cleaned before passing the barrier.

6.13 Clothing and footwear for use in clean areas is to be distinctively marked so as not to be confused with items worn outside clean areas, eg the toe caps of conducting shoes are to be painted red.

Shifting Lobby

6.14 A shifting lobby is an entrance room in a building operating under clean conditions. It is divided by a barrier into a 'clean area' and a 'dirty area', and the rules to be observed in this room are given in paragraphs 6.15 and 6.16. A typical layout of a shifting lobby is shown in Annex A, together with extracts from the rules. The shifting lobby is to be equipped as shown in Annex A.

Entrance and Exit

6.15 **Entrance.** Admittance to a 'clean area' is permissible only across the barrier, and is to be confined to those on duty. The following rules, as appropriate, are to be observed in addition to the general rules given in Regulation 4.4 Procedure 5:

a. **Personnel Employed in the Clean Area.** Before passing the barrier, personnel employed in the 'clean area' are to remove their outer clothing, ie coats, jackets, trousers and footwear, and after passing the barrier they are to put on the special clothing provided as listed in paragraphs 6.8a, c and f.

b. **Supervisory Staff and Visitors.** All supervisory staff and visitors are to:

(1) search their pockets to ensure the absence of all prohibited articles, eg keys and knives;

(2) turn down the ends of their trousers or overalls and brush off any mud or dust; and

(3) either:

(a) remove their boots or shoes;

(b) step over the barrier and put on red toe capped conducting shoes provided; and

(c) put on the dustcoat and cap (paragraph 6.8b and f) provided; or

(d) clean their boots or shoes of any loose dust or grit;

(e) put on overshoes and legstats (paragraph 6.8d) as they pass the barrier; and

(f) put on the dustcoat and cap (paragraph 6.8b and f) provided.

6.16 **Exit.** On leaving the ‘clean area’, the order of the rules for entrance is to be reversed.

Additional Regulations Applicable

6.17 The special requirements of clean conditions not dealt with in the preceding paragraphs are referenced in Table 6-1.

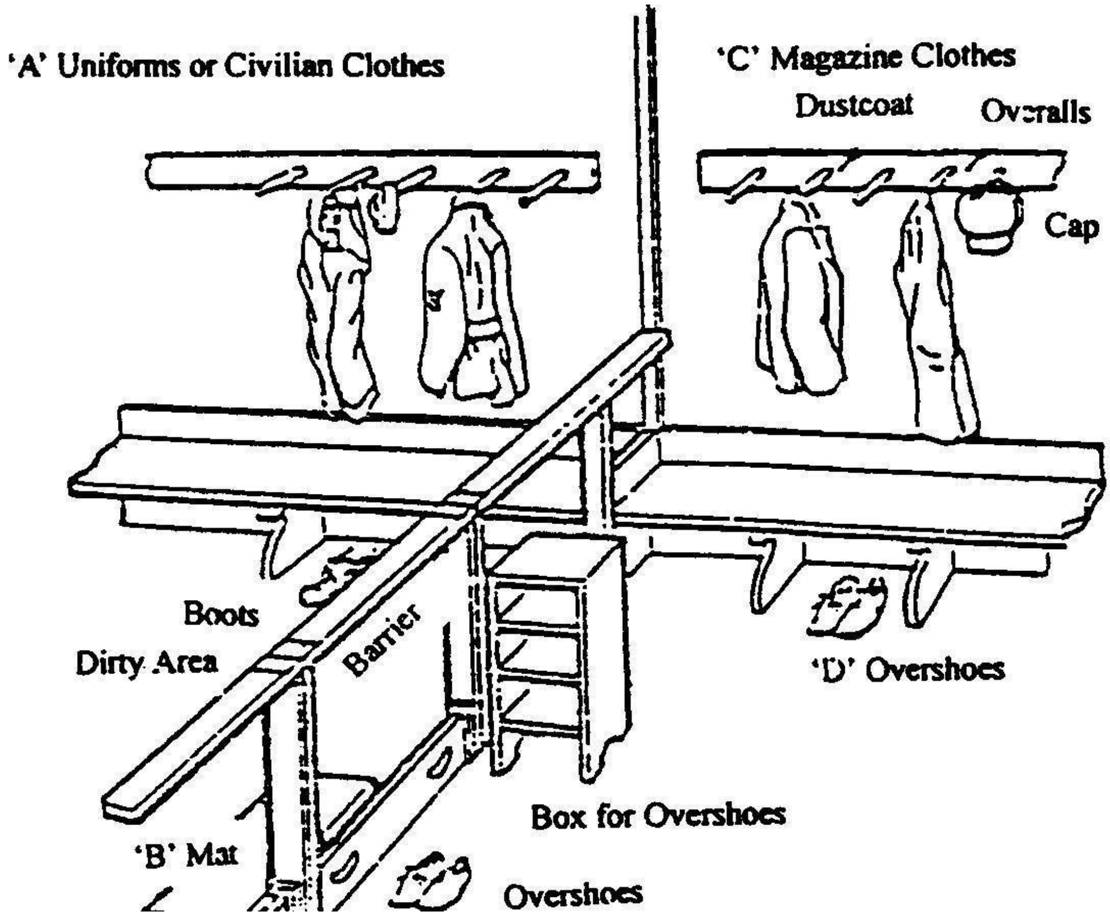
Requirements for:	Magazines	Workshops
Construction	Regulation 6.1 Procedure 1	Regulation 6.1 Procedure 1
Furnishings	Not Applicable	Regulation 4.4 Procedure 5
Lighting and Heating	Regulation 6.3 Procedure 1	Regulation 6.3 Procedure 1
Cleanliness	Regulation 4.4 Procedure 4	Regulation 4.4 Procedure 4
Tools and Equipment (additional to paragraph 6.7)	Regulation 4.4 Procedure 4	Regulation 4.4 Procedure 4
Operations	Regulation 4.4 Procedure 4	Regulation 4.4 Procedure 4

Table 6–1: Summary of additional applicable regulation

Annex:
A. Rules for Entering and Leaving a 'Clean Area'

ANNEX A

RULES FOR ENTERING AND LEAVING A 'CLEAN AREA'



INSTRUCTIONS

For Personnel Employed in the Clean Area

1. Wipe your boots or shoes on mat 'B' and take them off.

2. Take off your outer garments and hang them on pegs 'A'.

3. Pass the barrier in your socks and underclothes and then put on the special clothes, ie coveralls and cap 'C' and conducting shoes 'D'.

NOTE

On leaving the clean area the order of the above directions is to be reversed.

For Supervisory Staff and Visitors

4. Search your pockets to ensure absence of prohibited articles

5. Turn down ends of your trousers and brush them clean.

6. Either:

a. Remove your boots or shoes;

ANNEX A

b. Step over the barrier in your socks and put on the conducting shoes provided;

c. Put on a dustcoat and cap ‘C’; or

d. Clean your boots or shoes of any loose dust or grit;

e. Put on the overshoes and legstats ‘E’ as you pass the barrier;

f. Put on a dustcoat and cap ‘C’.

For All Personnel

7. Neither special clothes nor shoes must be taken outside the barrier, nor must outer garments, boots or shoes ever be bought inside it by personnel employed in the clean area.

8. If clean area shoes are allowed to collect grit they are just as dangerous and as likely to cause sparks as ordinary footwear.

NOTE

The instructions given above are to be displayed conspicuously at each entrance to every magazine and workshop operated under clean conditions.

PROCEDURE 7 - EXPLOSIVE ORDNANCE PREPARATION FACILITIES

Introduction

7.1 An explosive ordnance preparation facility is any area, room or building licensed as such at user establishments, in which Explosive Ordnance (EO) is unpacked, tested and prepared for use as required by the appropriate instructions, and in which these processes are reversed.

Purpose

7.2 This procedure addresses the administration of EO preparation facilities at user establishments. The general procedures of Regulation 4.4 Procedure 1 apply, and when preparation facilities are used for maintenance operations, as distinct from preparation, the conditions of Regulation 4.4 Procedure 5 are also applicable.

Applicability

7.3 The use of Integrated Weapon Facilities and Guided Weapon Workshops is very similar to that for preparation facilities as defined in this procedure except that it is normal practice for the maintenance of guided weapons and components to be undertaken simultaneously with preparation and testing operations. Since the facilities are designed on this basis, this procedure does not apply to them and they will be operated under different conditions as specified in Regulation 4.4 Procedure 8.

Construction

7.4 EO preparation facilities are to be constructed in accordance with the requirements specified in Regulation 6.1 Procedure 1.

Licensing and Authorisation

7.5 The EO preparation facilities referred to in this procedure are to be licensed in accordance with the requirements of Regulation 5.2 Procedure 1.

7.6 When a preparation facility is used as an EO workshop for maintenance purposes under the terms of Regulation 4.4 Procedure 5, the facility is to be separately licensed as such.

7.7 An Explosives Work Authorisation Board (see Regulation 4.4 Procedure 5) is to be used to display details of each new job undertaken in preparation facilities.

7.8 **Maximum Net Explosives Quantity.** The maximum Net Explosives Quantity (NEQ) permitted in any preparation facility, at any time, is not normally to exceed 1 200kg however, this limit may be increased at the discretion of the Licensing Authority to a maximum of 9 000kg NEQ. The quantity of EO and the number of personnel employed in the facility is always to be restricted to the minimum required to maintain the safe, economical and efficient functioning of the facility but the number of personnel must not exceed the number determined in accordance with Regulation 4.4 Procedure 5.

Multi-Purpose Explosive Ordnance Preparation/Storage Buildings

7.9 Multi-purpose EO preparation/storage buildings may be used for combined preparation, short-term storage of prepared EO and ready-use storage of ancillary explosive components associated with the preparation task. Preparation is not to be carried out in a compartment containing prepared weapons and the total NEQ held in the building at any time is not to exceed 1 200kg.

7.10 Pyrophoric countermeasures (class 4.2 dangerous goods) may be prepared for the mission with other ordnance in countermeasure preparation facilities and stored in ready use lockers with other ordnance. In these instances the pyrophoric countermeasures are to be treated as HD 1.3 for quantity distance purposes.

7.11 The terms of paragraphs 7.2 to 7.8 inclusive of this procedure are also applicable to multi-purpose EO preparation/storage buildings.

Electro-Explosive Devices – Testing and Fitting

7.12 A room intended to be used essentially as an Electro-Explosive Device (EED) preparation room, e.g. explosive bolt or aircraft power actuated device preparation room, is to be constructed to not less than the standard specified in Regulation 6.1 Procedure 1.

7.13 Where EED or stores containing them are handled, maintained, assembled, tested or prepared for use, the earthing and anti-static requirement of Regulation 6.3 Procedure 1 and 2 are applicable.

7.14 Working surfaces provided for the maintenance of EED are to be fitted with blast shields manufactured of not less than 3.0 mm mild steel plate. Shields are to be high enough to provide protection to the body without obstructing vision and of sufficient length to project at both ends at least 150 mm beyond the store being handled. Blast shields may be interchangeable for various types of store (see also Regulation 4.4 Procedure 1). Alternatively, blast shields made of clear plastic may be used, providing that they offer the same level of protection as the above mild steel plate.

7.15 All electrical testing of EED is to be carried out with the store placed in a special-to-type brick or metal box fitted with a secured steel plate lid, and vented to atmosphere. Operation of the test instrument to the EED should only be possible when the lid is closed and secured. For guided weapon maintenance facilities EED are to be tested in accordance with manufacturer's instructions and approved procedures.

7.16 The maximum quantities of explosives permitted to be tested in this manner are as follows:

a. HD1.1 - 2.5 grams

b. HD1.2 - 2.5 grams

c. HD1.3 - 500 grams

7.17 EED are to be tested only with the approved safety ohmmeter nominated in the process instruction.

7.18 Personnel are to dissipate body static electricity before entering the working area by grasping, for a brief period, the earthing device provided. During long periods of work, personnel are to repeat this process at regular intervals.

7.19 Personnel are to wear protective clothing, e.g. dust coats, at all times and conductive or anti-static footwear as prescribed in local or maintenance instructions. The footwear is not to be worn outside the working area and is to be kept clean and free from oil and dirt.

7.20 Suitable eye protection must be worn by all personnel whenever EED or their ancillary components are being tested or serviced. Face shields are the preferred equipment to provide such protection.

7.21 Protective gloves are to be worn only when handling components contaminated with fuels, greases or other noxious substances. The use of gloves made of highly insulating material is prohibited.

Electro-Explosive Devices – Testing and Fitting Outside EO Storage Area

7.22 Where it is necessary to test, or test and fit, electrically initiated cartridges, e.g. fire extinguisher or impulse cartridges, to parent equipments, and approved EO preparation facilities within an EO storage area are not provided, these operations may be undertaken in a selected area outside the EO area, e.g. aircraft maintenance hangar (see also Regulation 4.4 Procedure 9). The selected area is to be licensed and authorised for use in accordance with Regulation 5.3 Procedure 1.

7.23 The area is to provide sufficient space for the working surface and at least two operators. It may be in any suitable area within a building providing the walls are of brick, breeze block or concrete construction; or in the open with or without overhead cover. The area approved for these operations is to be located at least 3 metres from maintenance bays, flammable liquids or EO ready-use lock-ups.

7.24 A working surface and test fittings meeting the requirements of paragraphs 7.14 and 7.15 are to be provided. Any containers used for the storage of cartridges are to be of clean and unpainted metal, located on the working surface. Metal clamps, suitable to the types of stores to which cartridges are to be fitted, are to be firmly bolted to the working surface. During all operations, the operators are to stand on an earthed metal or conducting rubber mat. Alternatively, wrist straps may be used to ensure that no static charge accumulates on the operator's body.

7.25 The working surface and metal mat are to be bonded to an earth electrode and the total resistance to earth is to be maintained at 0.5 ohm or less. Earthing and bonding is to be in accordance with Regulation 6.3 Procedure 1.

7.26 Only the minimum number of cartridges compatible with the task in hand are to be on the work surfaces. The requirements of paragraphs 7.17 to 7.21 inclusive are to be applied.

Electrical Testing of Launchers and Similar Equipment

7.27 Under no circumstances are the electrical circuits of Decoy or Rocket Launchers and similar equipment to be serviced or tested in preparation facilities, unless such testing is part of the procedure for fitting the explosive components and is specified in the appropriate process documentation.

PROCEDURE 8 - INTERGRATED WEAPON FACILITIES AND GUIDED WEAPON WORKSHOPS

Introduction

8.1 Integrated Weapon Facilities (IWF) and Guided Weapon (GW) Workshops are facilities in which both maintenance and preparation for use or breakdown of guided weapons and ancillary equipment is undertaken. The introduction of programmable automatic test equipment (ATE) for routine testing of guided weapons has necessitated a review of the design concept for associated maintenance facilities. Design of ATE systems requires a separation between the test equipment room and test cell containing an explosives loaded weapon under test of only 30 electrical metres or less. This equates to a physical separation of less than 15 metres, which is well inside the limits for Process Building Distance separation for the quantities of explosives normally processed.

8.2 The concept of the IWF was developed in response to the requirement for these reduced quantity-distances whilst at the same time providing for the survivability of personnel, weapons and equipment in the case of an accidental explosion within any element of the facility. An IWF is an integrated system of explosive resistant barriers and shelters designed to protect other weapons, equipment and personnel from the effects of an accidental blast. Special equipment and techniques have been incorporated in the design to minimise the possibility of fire and to direct the effects of blast, fire and debris away from working areas.

Purpose

8.3 This instruction addresses the administration of Integrated Weapon Facilities and GW workshops. The instructions in Regulation 4.4 Procedure 1 and 5 are also applicable, except as amended herein.

Construction

8.4 IWF and GW Workshops are to be constructed to the requirements specified in Regulation 6.1 Procedure 1 in addition to the special design features necessary to ensure the survivability of other elements in the event of an accidental explosion in one element.

Licensing and Authorisation

8.5 IWF and GW Workshops are to be licensed on the appropriate Explosives Limit Licence form in accordance with the requirements of Regulation 5.2 Procedure 1. Each element of an IWF, ie each Weapon Assembly Room (WAR) and Test Cell (TC), or room in a Guided Weapon Workshop is to be separately licensed.

8.6 An Explosives Contents Board of suitable design is to be used to list the type and quantity of GW or explosive items permitted in each element or room of a facility at any given time. This board replaces the Work Authorisation Board required in explosives workshops by Regulation 5.2 Procedure 1. The Workshop Supervisor or equivalent is to formally authorise the type and quantity details shown on the Contents Board and all subsequent changes.

8.7 **Maximum Net Explosives Quantity.** The appointed Licensing Authority (see Regulation 5.2 Procedure 1) determines the maximum Net Explosives Quantity (NEQ) for GW Workshops and IWF, however the maximum NEQ for an IWF which can be authorised is not to exceed the design explosives limits for each element. In either instance the quantity of explosives and the number of personnel employed in the facility is always to be restricted to the minimum required to maintain the safe, economical and efficient functioning of the facility. Furthermore, since the weapons processed in IWF and GW Workshops are usually relatively high cost items and limited in numbers in the ADF inventory, the question of total value of assets which could be involved in a single explosive incident must also be considered when deciding on licence limits.

Explosives Safety

8.8 All explosives safety requirements prescribed throughout this manual apply within IWF and GW workshops. In particular, personnel are to observe the following precautions at all times while performing work on Guided Weapons or Guided Weapon sections:

a. Display Hazard Division signs externally on buildings whenever EO is contained within.

b. Discharge themselves to any provided earthing plates situated at the entrance to buildings.

c. Comply with Regulation 6.3 Procedure 2 for earthing of weapons and personnel.

d. If worn due to the provision of anti-static flooring, anti-static shoes are to be tested upon entry to the building. Anti-static wrist-stats are to be tested prior to use each day or after any suspected damage.

e. Comply with all Warnings, Cautions and other safety procedures in the authorised Weapon Processing Instructions and/or locally prepared safety and operating instructions.

f. Wear clothing appropriate to the task, either coveralls, dust coat or shirt and trousers of cotton or specialist anti-static/flame retardant material.

Instructions for IWF and GW Workshop Operations

8.9 No work of any kind is to be undertaken in IWF and GW Workshops unless it is described in Weapon Processing Instructions and/or locally prepared safety and operating instructions.

8.10 Operatives and supervisors undertaking any explosives work are to ensure that they have authorised work instructions and any other data they may require available at the work site. The instructions are to be constantly referred to by the operatives and supervisors to ensure correct processing and the safety of themselves and that of other personnel nearby.

Tools and Test Equipment

8.11 Only tools and test equipment authorised in Weapon Processing Instructions and/or locally prepared safety and operating instructions are to be used.

Operating Restrictions

8.12 **Roadways.** Vehicles and personnel are not permitted to proceed beyond activated red traffic lights on approach roads without prior permission from the appropriate weapon supervisor.

8.13 **Explosives Testing.** Unless authorised by the Directorate of Ordnance Safety (DOS) for Alongside Testing (AT), all testing of GW in a test cell with explosives or propellants present is performed remotely. No personnel are permitted to remain in the test cell, an adjacent test cell or the designated hazardous surrounding area when a remote test is in progress. Testing is not to be commenced if explosives loaded vehicles are at or approaching the adjacent WAR.

8.14 **WAR Loading Doors.** The main loading door between the WAR and its loading bay is to remain closed when a remote test is in progress in an adjacent test cell on an explosive loaded weapon.

8.15 **Loading Bays.** Loading and packaging operations are not permitted at a loading bay when a remote test is in progress on an explosives loaded weapon in an adjacent test cell. A test is not to be commenced if explosives are present in the adjacent loading bay.

Personnel and Explosives Limits

8.16 Personnel and explosives limits based on the requirements of Regulation 4.4 Procedure 5 are to be applied to operations conducted in an IWF and GW Workshop. These limits apply to an IWF provided the explosive design limits for any particular element in the IWF is not exceeded, otherwise the lower limit is to apply.

8.17 Unlike explosives workshops of conventional construction, the design features of IWF minimise the risk of serious injury from one room to another hence personnel limits need to be applied only to each WAR separately, with no overall building limit being applicable.

8.18 **Explosives Limits.** The following requirements apply to the promulgation of explosives limits and the handling of explosives loaded weapons or components in IWF or GW workshops:

a. The issued licence for each element of an IWF or room in a GW Workshop is to state the explosives limits by Hazard Division.

b. Any special conditions or caveats for use of the building are to be stated on the issued licence.

c. No Guided Weapons, weapon sections or explosive components are to be stored closer than one metre from any side wall or conductor forming part of the above ground lightning protection system (including the metal cladding of an outer wall which is bonded to the lightning protection system). In addition, no warhead is to be positioned within six metres of a wall adjacent to an adjoining citadel, or beyond the design warhead blast line of a TC unless in transit. The explosive perimeters are to be marked by a red line on the floor of the explosives building.

8.19 **Personnel Limits.** The following requirements apply to the determination and display of personnel limits in IWF and GW workshops:

a. Only essential personnel, i.e. those actually involved in work on GW plus supervisory staff who are always or frequently present plus associated inspection staff and authorised visitors are permitted in areas of IWF or GW Workshops which contain explosives.

b. Generally, the number of essential personnel must be kept to the minimum required for efficient, economical and safe operation of the facility.

c. The personnel limit for test cells when performing AT is to be the minimum number of personnel who are required to conduct the necessary test operations. Exceptionally, the OIC may authorise the presence of extra personnel for training purposes.

d. Personnel limits, both for essential personnel and visitors must be displayed in each explosive maintenance or test area.

8.20 **Personnel Accommodation.** No personnel are to be permanently accommodated in a WAR or TC. Any administrative work conducted in a WAR or TC must be limited to work essential in that area for efficient maintenance of GW.

Visitors

8.21 Occasional authorised visitors may be permitted in IWF and GW Workshops while work is in progress. The number of visitors at any time and the periods of stay are to be confined to the minimum consistent with the purpose of the visit, e.g. QA Audits, Re-certification Inspections, training or familiarisation visits etc.

8.22 Other than in exceptional circumstances, visitors are not permitted in areas of IWF or GW Workshops containing disassembled weapons exposing Electro-Explosive Device (EED), fuel, flammable gases or explosive. The OIC may allow visitors with a legitimate reason to enter areas containing disassembled weapons after ensuring they comply with the same precautions that apply to the GW operatives.

Design Limits and Operating Restrictions

8.23 When new IWF and GW Workshops are accepted for use, the design explosive limits for each workshop or IWF element within the facility, and the operating restrictions applying thereto, are to be included by the Licensing Authority on issued licences.

Safety and Operating Procedures

8.24 Detailed local safety and operating procedures for IWF and GW Workshops are to be prepared and promulgated to all personnel involved in the operation of the facility.

Compliance with Instructions

8.25 All personnel are to comply with approved local safety and operating instructions and the warning signs and notices displayed throughout the IWF and GW Workshops.

8.26 Compliance with these instructions is mandatory unless approval for deviation is obtained in accordance with Regulation 1.2.

8.27 Normally, IWF and GW Workshop's electrical equipment and fittings are to comply with the Restricted Electrical Area (REA) electrical standards specified in Regulation 6.3 Procedure 1. In particular, fixed fittings such as power outlets and light fittings are to comply. However, in large rooms where a number of different tasks, both explosive and non-explosive, are undertaken, it is permissible to divide the room into zones for electrical category purposes. Where zoning is proposed, an area of about five metres (exact dimensions can depend on room configuration) around the explosive item is to be permanently marked and all electrical fittings and equipment inside the marked area are to be REA standard. Electrical equipment and fittings outside the marked area do not need to be REA standard, but consideration should be given to cost effectiveness, commonality of fit out and flexibility in use of the facility.

8.28 Notwithstanding the requirements of paragraph 8.27, it is recognised that ATE and other special to type test equipment supplied by the Original Equipment Manufacturer (OEM) or authorised contractor may not meet all the REA requirements. Under written authorisation from the governing Authorised Engineering Organisation (AEO), electrical test equipment that does not meet all the REA requirements may be used. Guidance for the AEO is that the equipment must be specified by the OEM or other recognised authority, it must be appropriate for the task for which it is to be used and it must be maintained in good working order. The written authorisation is to be kept in the applicable work area.

8.29 The concession to REA requirements applies only to the maintenance of GW. Where non-guided munitions are to be maintained in a facility, the requirement for REA electrical equipment and fittings is to be maintained.

PROCEDURE 9 - UNDER-PRECAUTIONS FACILITIES AND OPERATIONS

Introduction

9.1 Certain operations are performed in explosive ordnance workshops on Explosive Ordnance (EO) which, because of its nature or condition, presents a potential hazard to the personnel involved. These tasks are performed under–precautions with the operator located remotely from the apparatus used for the operation and physically protected by a container traverse and/or mantelets from the effects of any inadvertent explosion.

Purpose

9.2 This procedure addresses the administration of EO workshop facilities in which 'under–precautions' operations are performed.

Applicable Procedures

9.3 The procedures in Regulation 4.4 Procedure 1 and 5 are also applicable to the administration of under–precaution facilities and operations conducted therein.

Licensing and Authorisation

9.4 Solitary under–precautions cells or EO workshops with under–precautions features are to be licensed in accordance with the requirements of Regulation 5.2 Procedure 1.

9.5 Details of the authorised task are to be displayed on an Explosives Work Authorisation Board (see Regulation 4.4 Procedure 5) in the under–precautions cell.

Approval to Conduct Under–Precautions Operations

9.6 Unless directed to conduct under–precautions breakdown by an external agency authorised to do so, any internally generated requirements to perform operations on suspect stores are to be assessed and authorisation to conduct the under–precautions operations is to be given, in writing, by the Officer-in-Charge of the establishment. These authorisations are in addition to normal facility tasking documentation.

Approved Maintenance Instructions for Under–Precautions operations

9.7 The types of EO and the circumstances under which operations on these items need to be performed under–precautions are to be defined in the relevant maintenance instructions. Under–precautions operations must only be performed in accordance with approved maintenance instructions.

Design Requirements for New or Modified Under–Precautions Facilities

9.8 When a new under–precautions cell is designed or major modifications are made to an existing cell, the cell is to be designed to contain the fragment and overpressure effects a single internal explosion of a level equal to the total Net Explosives Quantity (NEQ) of the item(s) proposed to be manipulated in the cell in any given operation. The siting of a new under–precautions cell is to take into account the high probability of an explosion occurring during its use.

9.9 Where the under–precautions cell is designed as an integral part of a workshop, the workshop design is to meet the normal design criteria for EO workshops and the requirements of paragraph 9.8 also apply to the design of the cell. In such integrated designs the remainder of the workshop cannot be in use when the under–precautions cell is being operated.

9.10 Major building modifications to under–precautions cells or to EO workshops incorporating such cells, are to be approved by the Explosive Ordnance Branch (EOB).

PROCEDURE 10 - MAINTENANCE OF WATERCRAFT, VEHICLE OR AIRCRAFT COMPONENTS CONTAINING EXPLOSIVES

Introduction

10.1 Where a requirement exists for the maintenance of watercraft, vehicle or aircraft components or assemblies containing small amounts of explosives, eg egress systems, fire extinguishers, cable cutters or emergency flotation equipment, a separate building or room of a building, or area located in the open, may be licensed to perform those operations specified in the appropriate maintenance schedule. The designated area or facility may be sited within an Explosive Ordnance (EO) area or any other suitable location external to the EO area, eg aircraft or vehicle maintenance hangar.

Purpose

10.2 This procedure addresses the administration of facilities or areas in which maintenance operations on components or assemblies containing explosives are to be performed.

Constructional and Safety Requirements

10.3 The building or room of a building in which the maintenance work will be performed is to meet the following requirements:

a. Have walls of brick (or equivalent material) at least 230 mm thick with openings only to normally unoccupied areas, eg building corridors or areas outside the building, otherwise the requirements of paragraph 10.7 apply;

b. Be free from readily flammable materials;

c. Be provided with appropriate fire fighting appliances;

d. Electrical lighting is to conform to local domestic standards; other electrical installations are to conform to the requirements of Regulation 6.3 Procedure 1; and

e. Lightning protection is not required for the building unless the building is sited within an EO area.

Licensing and Authorisation

10.4 The building, room or open area in which the maintenance work will be performed is to be licensed as a small quantity facility and authorised using Form EO 077 Authorised Use and Explosives Content of an Explosives Facility in accordance with Regulation 5.3 Procedure 1.

Authorised Maintenance Instructions

10.5 The operations to be conducted in the maintenance facility are to be authorised by appropriately approved maintenance instructions. No other operations are permitted in the particular room or area whilst explosives are present.

Maximum Net Explosives Quantity and Compatibility Mixing Rules

10.6 The maximum authorised Net Explosives Quantity (NEQ), for a facility located outside an EO area is not to exceed 1kg of Hazard Division 1.2 and/or 1.3 and/or 1.4 explosives. This NEQ limit does not apply if the facility is located inside an EO area. The mixing rules for explosives compatibility groups do not apply, irrespective of the location of the facility.

Quantity Distances

10.7 If the facility is located outside an EO area and the construction of the room or building does not meet the specifications of paragraph 10.3a, a minimum inside and outside quantity distance of 6 metres is to apply, measured from the walls of the maintenance facility to the walls of the other facility in question. If the facility is located within an EO area, the normal quantity distances are to apply as if the facility is a process building. If the maintenance area is in the open a quantity distance of 6 metres is also to apply.

Personnel Limit

10.8 The number of personnel should be limited to that required for efficient and economic completion of the tasks. Normally, at least two persons should be present in case of accident.

Display of Fire Symbols and Forms

10.9 Only the following symbols and forms are to be displayed:

a. If the facility is located outside a designated EO area, the appropriate fire division symbol on the outside of each door immediately leading into the maintenance area; and

b. Form EO 002 Small Quantity Facility Explosives Limit Licence and Form EO 077 inside the maintenance area immediately adjacent to the main entrance[1].

Testing and/or Fitting of Electro-explosive Devices and Electrically Initiated Cartridges

10.10 If the maintenance work being conducted under the requirements of this instruction requires that electro-explosive devices or electrically initiated cartridges be tested, or removed from, or fitted to the components or assemblies, the requirements of Regulation 4.4 Procedure 7, paragraphs 7.11 to 7.26 apply.

[1] Forms EO 001 to 005 and EO007 are available on application using Form AE303

PROCEDURE 11 - CONTROL AND OPERATION OF BURNING AND DEMOLITION GROUNDS

Introduction

11.1 Procedures for siting, establishing and licensing of burning and demolition grounds are detailed in Regulation 5.5 Procedure 1.

11.2 Before a burning or demolition ground is put to use, all personnel who will operate those facilities are to be trained and authorised as competent for those duties and they are to have available appropriately approved written procedures by which to operate those facilities and for undertaking destruction of individual items of Explosive Ordnance (EO) and other dangerous goods.

Purpose

11.3 This procedure specifies:

a. Responsibilities for the management of logistics disposal activities at burning and demolition grounds,

b. Minimum qualifications requirements for personnel carrying out disposal activities at such facilities, and

c. Measures and precautions applicable to the operation of such facilities.

RESPONSIBILITIES

Training and Authorisation of Personnel

11.4 The appropriate single Service authorities are responsible for prescribing training and authorisation requirements and for ensuring that all staff employed on duties involving the logistical disposal of EO are trained and authorised as competent for those duties. Minimum training and authorisation requirements are detailed in paragraphs 11.7 – 11.11.

Operating Procedures

11.5 Officers-in-Charge (OIC) of individual units and establishments are responsible for issuing operating instructions as follows:

a. **General Operating Instructions.** General operating instructions for burning and demolition grounds under their control are to be prepared in accordance with the guidance provided in this instruction. These operating instructions are to be formally approved prior to implementation.

b. **Specific Operating Instructions.** Specific instructions for the burning or demolition of individual types of EO are to be issued, drawing attention to the general instructions, as required, and specifying:

(1) The type and number of items of EO which may be taken into the burning or demolition ground at any time, including:

(a) EO to be destroyed;

(b) Ignition or demolition charges, including safety fuse or detonating cord;

(c) Initiators or detonators; and

(d) Firing devices;

(2) The type and number of items of EO which may be destroyed at any one time;

(3) the method of destruction;

(4) Specific misfire procedures, if not covered by the general instructions; and

(5) Specific environmental control measures, if not covered in the general instructions.

QUALIFICATION AND AUTHORISATION OF PERSONNEL

General

11.6 Because of the potential hazards involved in burning and demolition operations, it is essential that all personnel involved are familiar with the characteristics of the EO being disposed of, the ignition and demolition charges, the means of initiation and the precautions necessary to ensure safety. The training and authorisation requirements for personnel employed on burning or demolition grounds are to be specified as required by paragraph 11.4 and in accordance with Regulation 1.1 Procedure 1. The minimum requirements are detailed in paragraphs 11.7 – 11.11.

Training

11.7 All personnel taking part in burning or demolition operations must have completed training in the following subjects:

a. Explosives and explosive safety;

b. Explosives disposal techniques, which may be incorporated into the explosives course or be carried out independently; and

c. Occupational health and safety.

11.8 First aid training is desirable for all staff, but not essential, provided that at least one member of any team carrying out the burning or demolition task has a current first aid certificate (see paragraph 11.54).

Authorisation

11.9 All staff taking part in the disposal of EO must be authorised for those duties. The authorisation may be restricted in the type of destruction, eg burning only, or in the types of EO which may be destroyed.

Re-authorisation

11.10 Because of the potentially hazardous nature of disposal activities, it is essential that personnel carry out disposal tasks on a regular basis. Refresher training should be considered following a lengthy period that no disposal tasks have been carried out.

Withdrawal of Authorisation

11.11 If an individual is transferred to duties that do not require him or her to carry out disposal of EO, the authorisation may be withdrawn and the individual required to re-qualify if transferred back to duties involving disposal. Any breach of safety instructions will be cause for withdrawal of authorisation.

CONTROL AND OPERATING REQUIREMENTS

Authority for Disposal of Explosive Ordnance

11.12 Unusable Explosive Ordnance. Unusable EO is not to be destroyed before confirmation of sentence except in the following circumstances:

a. EO which is considered to be in such a dangerous condition that it could not be stored safely pending approval for disposal, and

b. EO recovered from EOD operations.

11.13 Breakdown. Breakdown is normally conducted for the following reasons:

a. Safety and Suitability for Service (S3) assessments,

b. Trials,

c. Defect investigations,

d. Recovery of economic quantities of produce from EO to be destroyed, and

e. Removal and replacement of unserviceable components in otherwise serviceable major assemblies or end items.

When breakdown for such logistical purposes is considered necessary, the activity is to be authorised by the appropriate controlling authority for these functions (e.g. Project Directors may authorise breakdown for trials or S3 assessments purposes, and Product Item Managers may authorise breakdown for defect investigation, disposal or maintenance purposes) and conducted in accordance with approved breakdown procedures. Policy for the breakdown of EO for all other purposes, including the breakdown of EO in declared Areas of Operation, is given in Regulation 2.4. Because of the risks associated with the breakdown of EO the general principle applicable to such activities is that they must not be undertaken by any individual or groups without proper authorisation in accordance with the policy prescribed here and in Regulation 2.4.

11.14 Foreign Explosive Ordnance. The principles of operational disposal should be applied to the logistical disposal of Foreign EO.

Recording of Disposal Activities

11.15 Records. Detailed and accurate records for burning and demolition grounds are to be maintained in a hardbound book with numbered pages. These records are to show, as a minimum:

a. The location of the burning or demolition ground.

b. Burning or demolition ground activity and use, i.e. date of use, location of activity, type of activity, Net Explosives Quantity (NEQ), type and quantity of EO or dangerous goods destroyed or used for destruction.

c. Names of the Conducting Officer and Safety Officer.

d. Site clearance and environmental tests and decontamination measures (as applicable).

11.16 Environmental Aspects. Destruction of explosives or EO, particularly burning operations, give rise to products hazardous to the environment, which may be leeched out of the soil and pollute local waterways. Compliance with Defence policy and procedures on environment and heritage protection (see Departmental (Department of Defence) Environmental Instructions), is mandatory. Actions taken to comply with environmental requirements must be recorded.

11.17 Retention of Records. Burning and Demolition ground records are not to be destroyed. If a burning or demolition ground is closed, the records are to be retained at the establishment for future reference. If an establishment which contains a burning or demolition ground is closed, the Officer-in Charge is to seek advice as to where the records should be sent or appropriate archival action is to be taken as a last resort.

Operating Hours, Weather and Light Conditions

11.18 Operating Hours. The hours during which destruction is permitted are to be specified. Normally, all destruction should be completed within working hours and by such a time that any small fires started by lobbed firebrands could be extinguished in daylight.

11.19 Weather Limits. The weather conditions under which destruction is not to take place or is to be suspended are to be specified, eg cloud base, wind speed and direction, imminence or approach of thunderstorms, declared fire restrictions. Disposal operations are not to be undertaken in high wind conditions, during thunderstorms or, for electrically initiated tasks, during sand or dust storms. Demolition on days of heavy overcast should be limited to avoid inconvenience to the civil community due to increased noise levels.

11.20 Safe Light. Disposal operations are not to be undertaken unless safe light conditions exist. Safe light conditions are considered to exist if all operations can be conducted without areas of darkness or shadow being present. As a guide, when relying on ambient light for illumination, safe light is usually available from one hour after sunrise until one hour before sunset. Disposal of EO is only to be undertaken during these hours of daylight. During heavily overcast days however, an earlier finishing time may be necessary due to reduced visibility.

Prohibited and Restricted Articles

11.21 Those articles which are prohibited or restricted in EO areas are also to be controlled in burning and demolition grounds, when in use. A list of such articles (see Regulation 4.4 Procedure 1), with any additions which the OIC may direct, are to be incorporated in standing orders and displayed prominently on warning signs at all entrances to burning and demolition grounds.

Food and Drink

11.22 The consumption of food and drink is to be strictly controlled inside burning and demolition grounds. Food and drink should not be introduced to burning and demolition grounds except where it is administratively or operationally inconvenient for personnel to leave the area for refreshment. In these circumstances the OIC may authorise the consumption of non-alcoholic drinks and food at approved places within the area. Attention must be paid to personal hygiene prior to the consumption of food and drink to avoid the ingestion of toxic residue from explosives. The introduction of alcoholic drinks into a burning or demolition ground is forbidden.

Control of Access

11.23 Keys. The entrance to demolition grounds should be controlled on all road entrances. Keys for entrance gates are to be issued during quiet hours to watchmen or duty staff. It is not necessary to control access to burning grounds when they are not in use, providing the ground is not located within the demolition ground.

11.24 Entry Control. During normal working hours, details of all personnel and vehicles entering or leaving the burning and demolition grounds are to be recorded by a gatekeeper situated at the entrance to the EO area. The gatekeeper is to maintain records sufficient to enable clear identification of the number of personnel and vehicles in the burning or demolition ground at any one time. Accurate records are essential to enable the timely evacuation of the area in the event of an emergency. During quiet hours, vehicles are not to enter the area without the permission of duty staff, and all details are to be recorded by the watchmen. The gatekeeper or watchman is to refuse access to personnel if the man limits of the burning or demolition ground are exceeded, unless the express permission of the OIC is obtained, or an emergency situation is in existence.

11.25 Sentry Posts. Sentry posts are to be sited so as to prevent the entry of persons or livestock into the burning or demolition ground when in use. The posts are to be located at all entrances to the burning or demolition grounds and any other locations deemed necessary, but in all cases are not normally to be sited any closer than the minimum Hazard Safety Distance[1] for the most hazardous nature undergoing disposal. Sentry posts sited within this Hazard Safety Distance are to be constructed to provide appropriate frontal, side and overhead protection, but must not obstruct the sentry's view of the approaches. For such items that may achieve fragment ranges beyond the Hazard Safety Distance, e.g. aircraft bombs[2], sentry posts sited within the predicted maximum fragment ranges are also to be given frontal, side and overhead protection.

Communications

11.26 Communications are to be established between the demolition shelter or the firing point of the burning ground, the sentry posts and the establishment's administration area. Communications should preferably be by landline, however radio or mobile phone communications may be used, provided that the Electro-Explosive Hazard (EEH) precautions in Regulation 6.3 Procedure 2 are strictly observed.

Control of Personnel

11.27 Disabled Personnel. Careful consideration should be given before employing disabled personnel in burning or demolition grounds. The disability should not limit coordination, movement, hearing or sight to such an extent that safety is compromised. Such persons are to be employed only when the OIC is satisfied that the nature of the disability is not likely to produce an unacceptable risk.

11.28 Personnel Limits. The number of personnel permitted in the disposal area during burning or demolition activities is to be kept to the minimum commensurate with safe and effective operation. Each burning or demolition ground is to have personnel limits prescribed to reflect the minimum number of personnel required for safe conduct of individual disposal tasks. The prescribed limits do not include visitors.

11.29 Visitors. Visitors are not to be admitted to the burning or demolition ground without prior approval of the OIC. They are to be briefed on safety and security requirements and are to be escorted at all times.

11.30 Non Commonwealth Employees. Personnel entering the burning or demolition ground who are not employed by the commonwealth, eg to carry out maintenance, read meters or who are employed by the agistment lessee, are to be issued with a written warning explaining that the burning or demolition ground may contain Unexploded EO (UXO) and other contaminants, and that they would be at some degree of risk. In addition, such personnel are to give an undertaking to comply with safety and security measures as required by the OIC, including liability for search of both personnel and vehicles. Access by such personnel is to be strictly controlled for safety and security reasons.

11.31 Briefing. The OIC is to ensure that personnel entering the burning or demolition area are briefed on the following aspects prior to entry:

a. Prohibited articles,

b. Restricted articles,

c. Emergency procedures,

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[1] The Hazard Safety Distance is the measured or theoretical maximum range for all predictable fragments for the EO item under consideration. It should be noted that occasional unpredictable fragments, due to the construction of certain items, may achieve ranges in excess of this Hazard Safety Distance, e.g. nose section, baseplate and suspension lugs of aircraft bombs. Accordingly, special attention should always be given to the orientation of such items since fragments from these areas will travel the maximum distance.

[2] The prescribed Hazard Safety Distance equates to the 'Predicted Maximum Fragment Range' given in the United States Series 60 Explosive Ordnance Disposal publications.

d. Security requirements,

e. The likelihood of UXO,

f. The hazards of handling UXO, and

g. Any other restrictions.

11.32 Drugs and Alcohol. The introduction or the consumption of non prescription drugs or alcohol within burning or demolition grounds is not permitted.

11.33 Level of Competency. The OIC is responsible for ensuring that all personnel employed on disposal tasks are adequately trained, have the appropriate experience applicable to the task in hand and are authorised as required at paragraph 11.10.

Control of Vehicles

11.34 Authorised Vehicles. Vehicle access to burning or demolition grounds is to be limited to the minimum necessary for the transport of personnel and EO to the site. Vehicles are to leave the hazard area once they are no longer required for the task. The officer responsible for the conduct of the disposal task (Conducting Officer) may retain one vehicle. It should be parked where it is unlikely to be damaged by debris, eg behind a traverse, and parked facing away from the site to facilitate evacuation if this becomes necessary.

11.35 Private Vehicles. The use of private vehicles, other than commercial/tradesmen's vehicles should not be permitted within burning or demolition grounds.

11.36 Inspection of Vehicles. Vehicles involved in burning or demolition tasks are to be safe and suitable for the tasks.

11.37 Carriage of Personnel. Personnel are not to travel in load area of a vehicle carrying EO, whether the EO is serviceable or not.

11.38 Radio Transmitters including Mobile Telephones. Vehicles entering burning and demolition grounds are to be inspected to ascertain that those radio transmitters not approved for use within the area are switched off. The occupants are to be warned not to switch on or transmit whilst inside the area.

11.39 Speed Limits. Speed limits within burning and demolition grounds are dependent on local conditions, but in any case are not to exceed 40 km/h. Speed limits are to be signposted at all entrances to burning and demolition grounds and at selected points within the ground.

11.40 Road Condition Cautionary Signs. Use is to be made of standard road condition cautionary signs to signpost traffic hazards within burning and demolition grounds.

11.41 Transport of Explosive Ordnance for Disposal. The following precautions are to be observed when transporting EO for disposal:

a. EO filled WP is to be transported as a separate load;

b. Vehicles may transport EO for disposal to an area adjacent to, but not closer than 10 m (except for propellant disposal tasks) from the disposal site;

c. Vehicles are not permitted closer than 25 m to unpacked propellant;

d. Vehicle engines are to be switched off when EO is being loaded or unloaded; and

e. Vehicles loaded with EO are to be unloaded and removed to a safe area prior to opening any packages containing EO for disposal or demolition explosives.

11.42 **Parking.** Vehicles loaded with EO are not normally to be parked overnight in burning or demolition grounds.

Control of Airspace

11.43 Current policy on control of airspace is contained in Australian Ordnance Council (AOC) Proceeding 205.95 '*Control of Airspace Above Explosive Facilities and Sites of Planned Demolitions*' dated 14 July 1992 and is to be consulted as required.

Special Fire Precautions

11.44 **Inspection of Firebreaks.** Firebreaks around burning and demolition grounds are to be inspected for serviceability prior to disposal tasks being undertaken.

11.45 **Inspection of Area.** Burning and demolition grounds are to be inspected prior to disposal tasks being undertaken, to ensure that grass, undergrowth and other ground cover does not present a serious fire risk.

11.46 **Inspection of Firefighting Equipment.** First attack firefighting equipment must be available at firefighting points near to the destruction site. The firefighting points are to be inspected prior to disposal tasks being undertaken to ensure availability and serviceability of all items of equipment. Adequate supplies of fire beaters, knapsack sprayers filled with water and rakes are to be available. If a reticulated water supply is available, hoses are to be rigged ready for immediate use. If a static water source, such as a tank or dam is used, the pump must be tested prior to commencing destruction operations.

11.47 **Requirement for Firefighting Vehicle.** Under adverse fire conditions a firefighting vehicle may need to be dedicated to the disposal activity or be available at immediate notice.

11.48 **Special Precautions.** All fire precautions special to the nature of EO to be destroyed are to be taken.

11.49 **Final Inspection.** On completion of disposal operations each day, the Conducting Officer is to ensure that the area is inspected to ascertain that all flammable material is destroyed and smouldering vegetation or debris is extinguished.

Conduct of Operations

11.50 **Pre-disposal Actions.** The requirements detailed in paragraphs 11.52 – 11.58 are to be implemented prior to any disposal task being undertaken.

11.51 **Notification to Civil Authorities.** Well prior to disposal operations the Conducting Officer is to liaise with the following local authorities to ensure advance notice to the civil community:

a. Police.

b. Air Services Australia.

c. Local airport/flying schools.

d. Fire or Bushfire Brigades.

e. Local hospital or medical centre.

11.52 **Warning to Establishment Staff.** The following establishment personnel will normally require prior warning of planned disposal operations:

a. Establishment management.

b. Establishment security.

c. Establishment fire station.

d. EO Workshop supervisor(s), so that workshop operations can be modified or suspended as necessary.

e. Establishment medical or first aid section.

11.53 Communications. Communications are to be established between the burning or demolition ground, the sentry posts and the establishment's administration area. The designated telephone or radio in the administrative area is to be manned at all times while the disposal operations are in progress.

11.54 Mandatory medical support. All burning and demolition activities require mandatory medical support in accordance with LWP-G 7-3-1 Australian Defence Force Range Orders (Land).

11.55 Inspection of Demolition shelter. The Conducting Officer is to inspect the demolition shelter to ensure its serviceability prior to conducting disposal tasks. Fixed firing circuits and communication links should also be checked at this stage.

11.56 Fire Prevention and Firefighting Checks. The Conducting Officer is to undertake the fire checks specified in paragraphs 11.45 – 11.49 prior to any disposal operations.

11.57 Escape Routes. Escape routes are to be kept clear and checked prior to destruction activities commencing. The Conducting Officer is to ensure that all personnel are familiar with the escape routes and the procedure for ordering evacuation in the event of an emergency.

11.58 Warning Flags and Sentries. Red warning flags are to be used to indicate that the burning or demolition ground is occupied and that destruction of EO is about to take place. Sentries are to be posted so as to prevent the entry of persons or livestock into the burning or demolition point. Sentries are to be located at all entrances to the area and any other locations deemed necessary, but in all cases are not to be sited any closer than the minimum unprotected safety distance applicable to the most hazardous nature for disposal [1,2]. Depending on the topography, additional sentries may have to be posted to prevent personnel approaching dangerous areas along routes hidden from the firing point.

11.59 Briefing of Sentries. Each sentry is to be briefed on the disposal task being undertaken and provided with the following:

a. Details of the danger area;

b. A duty statement;

c. A communications net diagram;

d. Explicit instructions on action to be taken in respect of all persons approaching or entering the demolition or burning ground;

e. A radio or other suitable means of communication; and

f. A red flag.

11.60 Controlled Articles. The Conducting Officer is responsible for controlled articles taken into the burning or demolition ground. In particular, smoking materials are to be controlled by the implementation of the following procedures:

a. Prior to entering the burning or demolition ground, or EO area if entry is through that area, all smoking materials are to be collected and placed in a lockable container.

b. This container is to remain under the control of the Conducting Officer.

c. A clearly defined smoking area is to be established not less than 50 metres from the destruction point or any area where EO is being used.

11.61 Storage and Transport of Explosive Ordnance. All demolition stores to be used on disposal tasks are to be transported and stored in their service containers until immediately prior to when they are required for use. In particular, electrically initiated demolition stores such as Cap Blasting Electric are to be carried in their service package or when a fraction quantity is required, in a totally enclosed steel package, such as the M19A1, until immediately prior to use. Such packages are not to be opened within the applicable frequency hazard safety distance of any radio equipment being used.

11.62 Security of Explosive Ordnance. EO for use during disposal tasks is to be placed in a secure location at the burning or demolition ground. EO is to be guarded if it is necessary for personnel to move out of sight or be more than 100 metres away.

11.63 Personal Safety Equipment. All personnel involved in disposal tasks are to wear protective dress which may include safety boots (anti-static if electro-explosive devices are involved), facemask or goggles, long-sleeved fire-resistant overalls, helmets, gloves and earmuffs.

11.64 Conduct of Disposal Tasks. The conduct of disposal tasks is to accord with the following:

a. **Operating Instructions.** The operation of burning and demolition grounds during disposal tasks and the conduct of individual disposal tasks are to accord with the instructions issued in accordance with the requirements of paragraph 11.5.

b. **Misfire Procedures.** Precautions must be taken in the event of a misfire particularly in regards to the minimum waiting time to be observed. The minimum waiting time is to be at least ten minutes when using electrical initiation methods and thirty minutes when the non-electric method is used. Safety must be the overriding consideration.

11.65 Post-disposal Actions. Following the completion of individual disposal tasks or at the end of the working day, as appropriate, the Conducting Officer is to ensure that, as a minimum, the following actions are implemented:

a. The requirements detailed in paragraphs 11.50, 11.67, 11.69 and 11.77 – 11.79.

b. The recording requirements of paragraphs 11.15 – 11.17, as appropriate.

Packages and Produce

11.66 Free From Explosives (FFE) Certification. The Conducting Officer is to ensure that all packaging and produce, prior to its removal from the burning or demolition ground, is inspected and certified FFE (see Regulation 2.3 Procedure 1).

11.67 Recovery of Produce. No produce which cannot be certified FFE or which might contain toxic residue is to be removed for resale. In particular, produce from SAA burns is not to be recovered but removed to a secure metal tip.

11.68 Removal of Produce. At the completion of each days disposal tasks, and before leaving the burning or demolition ground, all personnel, including sentries, are to be warned by the Conducting Officer of the consequences of removing produce from those areas.

Special Provisions

11.69 Design, Construction and Approval of Destruction Facilities. Where specific facilities, eg pits, drums, demilitarisation furnaces, detonator destructors, etc, are utilised for destruction, the design, construction and operating restrictions are to be approved by the Explosives Ordnance Branch (EOB) Some facilities, such as demilitarisation furnaces or detonator destructors, are designed to contain the effects of deliberate detonation of small quantities of EO. The operation of these machines is to be considered by the Licensing Authority in conjunction with burning or demolition ground licence applications.

11.70 Decontamination of Plant. Burning grounds may be used for the decontamination of plant items by heating, using a gas flame or other fire. Before heating, every effort must be made to remove all explosive contamination from the items. The items must be approved by a suitable technically qualified person delegated by the establishment OIC, as suitable for decontamination by heating.

Inspection of Burning and Demolition Grounds

11.71 Burning and demolition grounds are to be inspected for the following aspects at least every three months:

a. Cleanliness;

b. Serviceability of boundary fencing;

c. Serviceability of fixed communications;

d. Signposting (entrances and boundary fence);

e. Serviceability of fire fighting equipment;

f. Fire breaks; and

g. Estate management.

Estate Management

11.72 Environmental Management Plan. A balanced plan of environmental management is to be implemented in accordance with Departmental (Department of Defence) Environmental Instructions.

11.73 Firebreaks. The requirement for firebreaks is as detailed in Regulation 4.5 Procedure 1, paragraph 1.12.

11.74 Fire Fighting. Fires burning in known demolition grounds are not to be fought from within that area because of the danger from UXO. Fire fighters should concentrate on preventing the spread of the fire to bordering areas.

11.75 Environmental Aspects. Disposal sites within burning and demolition grounds are to be located to lessen any environmental impact on the local area. Of particular concern is secondary damage from wind and water erosion.

11.76 Site Clearance. On completion of any destruction of EO, the site is to be searched and cleared of any residual explosives. The search area is to be wide enough to ensure that any lobbed EO or explosives are recovered. Any waste contaminated with explosives, eg the wrappers for PE, is also to be collected. All the recovered items are to be destroyed, usually as the final operation of the day.

11.77 Clearance of Residue. On completion of each days activities or weekly during large scale disposal tasks, remaining residue, such as non-explosive components and large fragments are to be gathered into a designated collection area for later removal. This operation is to be conducted under the direct supervision of a suitably qualified officer who is to ensure that the work party is briefed as to the identification of possible hazards and action to be taken if encountered. At the same time, disposal areas should be restored by filling craters and removing debris from roads, tracks and work areas.

11.78 Disposal of Residue, Inert Explosive Ordnance and Components. Residue collected from burning and demolition grounds, inert EO and components for disposal by mutilation and burial are to be placed in inert rubbish tips.

11.79 Vermin Control. Active measures are to be taken to eliminate vermin from burning and demolition grounds. Vermin control parties are to be briefed as to areas that may be accessed; personnel are not to enter areas that could be contaminated by UXO. See Regulation 4.5 Procedure 1 paragraphs 1.26 – 1.28 for further details.

11.80 **Firing Ranges.** Firing ranges are not to be sited within burning or demolition grounds.

Surrender of Burning or Demolition Grounds

11.81 When a burning or demolition ground, either in whole or in part, is no longer required for the disposal of EO and its use as such is to be surrendered, the provisions of DI(G)ADMIN 63-1 – *Management of Land affected by Unexploded Ordnance* are to be implemented.

PROCEDURE 12 - USE OF EXPLOSIVES FOR DISPLAYS AND DEMONSTRATIONS

Introduction

12.1 The use of any explosives for display/demonstration (hereinafter called display) purposes, but in particular the use of commercial fireworks, can be extremely hazardous to both operators and spectators alike if appropriate procedures are not applied and safety precautions not taken at all stages of an event.

Purpose

12.2 This procedure prescribes requirements for the storage and use of military Explosive Ordnance (EO) and commercial explosives for display purposes, and the procedures and safety precautions to be observed.

Applicability

12.3 Except where specifically excluded at paragraph 12.4, this procedure applies:

a. In all situations where explosives or pyrotechnics, including theatrical effect explosives and fireworks in UN Class 1, are used or stored for official or private display purposes.

b. When the display is organised by Defence, or is conducted on Defence owned or controlled property, or is conducted outside Defence owned or controlled property where Defence personnel are participating and are on duty.

c. To significant public firework displays involving major Defence assets such as ships or aircraft, eg Centenary Naval Review, Amberley Air Show.

12.4 This procedure does not apply to:

a. Events such as firepower demonstrations, where complete weapon systems are demonstrated to military and/or civilian audiences at approved firing ranges.

b. Operation of saluting guns that are controlled by single Service gun drill procedures.

c. Firing of blank SAA at Unit Open Days and authorised Unit training where local safety procedures address the activity.

d. Functioning of Navigational and/or Emergency signalling pyrotechnics for the purpose of training or demonstration where a local procedure addresses the activity.

e. The conduct of commercially operated Battle Noise Simulator and Battle Effects displays for the training of Defence personnel by state/territory approved operators using commercial explosives. These activities are authorised provided they are conducted via an authorised contract and are conducted in accordance with AS2187 and state legislation.

f. The conduct of Battle Noise Simulation and Battle Field Effects Simulation when conducted in accordance with single service doctrine (i.e. LWP-G 3-6-6 Demolitions) using approved service explosives, simulation systems and techniques.

Licensing

12.5 Display areas are to be licensed by the Licensing Authority, located in the Explosives Ordnance Branch, using Form EO 005 Fireworks and Display Area Licence[1] (See Regulation 5.2 Procedure 1).

Display Management

12.6 For each display a Safety Officer is to be appointed by the Officer-in-Charge (OIC) of the unit concerned with organising the display. The Safety Officer should be of Senior Non-commissioned Officer (SNCO) rank or classification of APS Level 6 (TO4) as a minimum. The Safety Officer should have a sound appreciation, through training or experience, of the explosive effects of the items to be fired and all hazards associated with their use. For each display a Display Operator is also required. The responsibilities of Display Operators are defined in Australian Standard 2187.4 - 1998 *Explosives - Storage, Transport and Use Part 4: Pyrotechnics – Outdoor Displays* (AS 2187.4 - 1998) and their competencies are addressed in paragraphs 12.9 to 12.10. The Display Operator may be a contractor or may be appointed by the OIC of the unit concerned. Where appropriate the one person may perform both the duties of the Safety Officer and the Display Operator.

12.7 When a commercial operator is engaged the Safety Officer is to sight a current Display Operator's Licence and a Public Liability Certificate of Currency.

Operation of Displays

12.8 Displays are to be conducted in accordance with the provisions of AS 2187.4 - 1998, particularly Section 4.

Competency of Display Operators

12.9 Defence staff, trained in the use of Defence EO, are not to be assumed as competent firework Display Operators but must take advantage of courses provided by the individual firework manufacturers or other accredited trainers to gain such competencies. The use of either a professional Display Operator or the firework manufacturer to conduct the display should be considered as the first option.

12.10 Displays involving the use of fireworks are not to be conducted by Defence personnel who are not trained in their use. The Display Operator is to be licensed under the relevant State legislation. If military EO or commercial explosives (not fireworks) are to be used, the Safety Officer or the Display Operator is to hold a current Defence qualification to initiate the items to be used.

Safety Assessment of Display

12.11 The reasons for conducting displays are to entertain or awe spectators and/or expose them to simulated battle effects. Such occasions, while requiring spectators to be proximate to the displays, are always to be conducted within the requirements and spirit of the explosives safety rules in AS 2187.4 - 1998 and this Manual. The spectators need to be located close enough to experience the visual and sound effects of the explosives without being so close as to face the risk of injury. Safety distances are to be determined in accordance with AS 2187.4 - 1998 and paragraph 12.24, as appropriate.

Significant Public Firework Display

12.12 When significant Defence assets are to be used in conjunction with a public firework display single Service safety authorities have prime responsibility for the safety of those assets and spectators, and are to ensure that appropriate risk assessments are conducted. Joint Logistics Command (JLC) staff will provide explosives safety expertise to the display management entity as requested.

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[1] Form EO 005 is available on application using Form AE303

Use of Defence Explosives

12.13 Defence owned or controlled EO is not to be used for non-public funded displays.

Displays Using Commercially Procured Explosives

12.14 Displays using commercially procured explosives for activities such as theatrical effects at air shows, open days, ceremonials and similar functions, are normally to be limited to explosives of HD 1.3 and HD 1.4. If so limited, the approval of the Deputy Director Explosive Ordnance Licensing Authority (DDEOLA) at DEOLC in accordance with paragraph 12.20 and site licensing in accordance with paragraph 12.5 are not required. The Safety Officer for the display is to ensure that the provisions of AS 2187.4 - 1998 are adhered to. If the display site perimeter, as calculated from the methodology outlined in AS 2187.4 - 1998 is within 200 m of a valuable or hazardous Defence asset (see Annex A), the single Service safety authority is to be consulted.

12.15 All fireworks are to be manufactured and labelled in accordance with paragraph 2.1 of AS 2187.4 - 1998 and packaged and transported in accordance with paragraphs 2.2.1 and 2.2.2 of AS 2187.4 - 1998. Other explosives are to be labelled with the hazard classification code (HCC) as a minimum.

12.16 It is recommended that complete display kits be purchased which include instructions for setting up the display area and detailed operating instructions.

12.17 JLC staff are able to provide advice on the safety aspects of display contracts or proposals, if required.

Storage of Commercially Procured Explosives

NOTE

Due to the higher risks presented by the storage and handling of fireworks compared to authorised Service EO, this storage should normally be in an isolation storehouse if available.

12.18 Fireworks may be stored during the day at the display site for use the same night in accordance with paragraph 2.2.3 of AS 2187.4 - 1998. Fireworks may also be stored for up to 72 hours in a licensed EO storage building or other suitable facility at the discretion of the Licensing Authority. Commercial explosives of HD 1.1 and 1.2 are always to be stored in accordance with the provisions of this manual. Particular care is to be taken when handling fireworks due to the inherent weakness of the paper or cardboard cases and the high probability of spillage of the filling. On arrival, and prior to storage in an EO storage building, the fireworks are to be suitably over-packed to prevent the leakage of black powder or pyrotechnic composition. Firework fillings are very sensitive to impact, friction, heat or sparks. Storage facilities are therefore to be carefully cleaned before and after fireworks storage, and before any other explosive is stored. If fireworks are to be stored for periods in excess of 72 hours, the Safety Officer for the display is to apply to the Secretary, Explosives Storage and Transport Committee (ESTC) in the Directorate of Ordnance Safety for formal classification prior to the arrival of the fireworks at the unit. Receipt of formal ESTC classification is necessary for storage of fireworks in excess of 72 hours.

Use of Military Explosive Ordnance and Commercial Explosives (Not Fireworks)

12.19 When an explosive demonstration is part of an authorised training syllabus, it may be carried out at a licensed demolition ground, burning ground or approved EO firing area without reference to a higher authority. When it is intended to include a demonstration in a new training course, the course sponsor is to obtain approval for the explosives activity through single Service channels and apply to the Licensing Authority if a new or revised licence is required.

12.20 When military or commercial explosives of HD 1.1 or HD 1.2 are to be used for displays (other than for approved training courses), authority is to be obtained in advance from EOLA for each occasion. Normally, a minimum of 28 days notice is required. Requests are to be made by the Safety Officer for the display and are to include the following information:

a. Purpose and details of the display.

b. Date and location of the display.

c. Proposed display site.

d. A marked up map of the display site showing the distance of display sites from:

(1) Spectators.

(2) Inhabited buildings, vital installations and other buildings and facilities.

(3) The firing party.

(4) Taxiways.

(5) Runways.

(6) Radar and radio installations.

(7) POL facilities.

(8) The Departmental property boundary.

e. Type and quantity of explosives to be used, and initiation method.

f. Distance between charges.

g. Type of ground at the display site, type of soil, length of grass, tree cover, terrain features etc.

h. Misfire and disposal procedure to be used.

i. Proposed action to inform local authorities, hospitals, unit personnel, etc of the planned display.

j. Safety arrangements for the display party.

k. A copy of the display instruction.

l. Fire fighting facilities.

m. Details of the display party, their qualifications and recent training history.

n. Confirmation that an underground cable and services clearance has been conducted in the display area.

o. Details of the system for controlling and coordinating the firing to ensure major assets and crowd safety, eg sentries, radio links, landlines etc. The system of control is to be designed to be fail-safe, ie no firing is to take place until the display controller, who is to be in a position to observe the whole area, gives a positive clearance to fire.

12.21 The requirement at paragraph 12.20 is based on a reasonably extensive display using a total NEQ greater than 1 kg and involving non-departmental spectators or a large group of departmental employees. Small displays are also undertaken where the total NEQ is less than 1 kg and only a small group of departmental employees are present as spectators, such as for ad-hoc bomb awareness training. In this instance approval (paragraph 12.20) and site licensing (paragraph 12.5) are required, but only the elements of paragraph 12.20 sub-paragraphs a, b, c, e, and j need be addressed and a simple site plan is to be provided to the approval authority.

Limits on Types and Quantities of Explosives

12.22 The following Defence EO may be used for displays:

a. Detonating Cord, up to 10 g/m loading density.

b. Plastic Explosive PE4.

c. Caps Blasting Electric and Non-electric.

d. Igniters Time Blasting Fuse Electric.

e. Fuze Blasting Time.

f. Non-electric (NONEL) system items.

g. CE primers, simulators and similar non-fragmenting explosives.

h. Various flares and signalling devices.

12.23 The Net Explosives Quantity (NEQ) of HD 1.1 explosives used in the make-up of any single effect is to be the minimum to produce the desired effect, but is not to exceed 0.23kg (8oz). Small quantities of POL, not in excess of 10 litres per container, may be used for pyrotechnic effects and must be contained in non-fragment producing containers eg plastic not metal. Wherever possible, initiation of charges is to be conducted using electrical methods. Such initiation is to be carried out using Service approved initiating devices. Improvised means of initiation are not permitted, eg bare batteries not contained in a firing device.

Safety Distances

12.24 The safety distances for fireworks are to be in accordance with AS 2187.4 - 1998. Where HD 1.1 or 1.2 explosives are to be used, the display site is preferably to be a licensed demolition ground, burning ground, or EO firing area, or, for applications in accordance with paragraph 12.20, the minimum safety distances to be applied are the authorised demolition safety distances for the particular explosives to be used.

Display Models and Props

12.25 Display models or props built to be destroyed, or which may be potentially destroyed by explosives, particularly when HD 1.1 explosives are used, are to be constructed from non-lethal fragment producing materials such as paper, cardboard, polythene, plastic ties and adhesive tape etc. The use of wood is to be confined to small quantities, by weight and surface area, of thin plywood. Wooden battens, metal objects, nails, metal banding tape and similar items are not permitted. Similarly, to reduce the potential for lethal fragments, the use of metal cordtex junction clips is not permitted.

Post – Display Actions

12.26 **Site Clearance.** At the conclusion of the display, a thorough search of the display area is to be conducted by the Safety Officer to ensure the area is free from explosives and explosives refuse. The display instruction is to indicate this requirement.

12.27 **Post Display Evaluation.** The Safety Officer is to conduct a post–display evaluation. The evaluation should focus on the adequacy of the outcomes of the event in relation to the safety factors considered in the planning phase, with a view to improving the requirements of this instruction. The evaluation report is to be forwarded to DEOLC (DDEOLA). Any suggested improvements are to be forwarded to the sponsor of this Manual.

Annex:

A. Valuable or Hazardous Defence Assets

ANNEX A

VALUABLE OR HAZARDOUS DEFENCE ASSETS

1. When a fireworks display is being planned, safety distances are to be in accordance with the provisions of Australian Standard 2187.4 – 1998 Explosives - Storage, transport and use - Pyrotechnics - Outdoor displays (AS 2187.4-1988).

2. However, when sites and facilities exposed to the firework's effects are valuable or hazardous Defence assets and within 200 m of the display site perimeter, the relevant single Service safety authority is to be consulted – see Regulation 4.4 Procedure 12 paragraph 12.14. The following assets are prescribed for the purposes of this approval:

a. Military war-fighting vehicles, vessels or aircraft.

b. Control centres and workshops for the equipment at sub-paragraph a.

c. Communication or navigation aid towers, transmitters or receivers.

d. Petroleum, Oils and Lubricants storage greater than 500 litres.

e. EO licensed facility.

f. Large flammable areas such as tent camps.

g. Other facilities deemed by local commanders to be vital for base, establishment or force operations.

PROCEDURE 13 - PRINCIPLES FOR THE OPERATION OF SMALL QUANTITY FACILITIES

Introduction

13.1 Limited quantities of Explosive Ordnance (EO), usually of less than 50 kg Net Explosives Quantity (NEQ) and required for specific operational or training use may be stored or processed in designated open areas, buildings, rooms or special containers usually located outside designated EO storage areas. Such a facility is known as a ‘Small Quantity Facility’ (SQF) and is to be licensed using Form EO 002 unless not required in accordance with Annex A paragraph 24 to this procedure.

Purpose

13.2 This procedure prescribes the requirements for the operation of SQF.

Applicability

13.3 This procedure applies to all SQF unless specifically stated otherwise.

Siting of Small Quantity Facility

13.4 The establishment, siting and installation of SQF must be closely coordinated with:

a. The Licensing Authority (LA) to ensure that the facilities are established only on the basis of actual and genuine need, and

b. The responsible security authority to ensure that the necessary security standards are implemented and maintained.

13.5 The siting of SQF does not require the convening of a Board of Officers (see Regulation 5.1 Procedure 1 paragraph 1.4). However, advice is to be sought from the LA prior to any siting commitment and/or construction.

13.6 Generally, a SQF should not be sited adjacent to, or in a room or compartment in which incompatible processes[1] are undertaken, or is assessed as a Domestic Inhabited Room (DIR)[2]. It may be in a compartment where related maintenance activities are undertaken, but is to be at least 3 m from incompatible processes within that room unless otherwise determined by the LA. Where it is essential that an incompatible process be in an adjacent compartment and the EO in the SQF is unpacked, then the separating wall is to be of fire proof construction and is to be full ceiling height. SQF are to be at least 10 m from bulk storage of liquid Dangerous Goods (DG) that exceeds 200 litres and 25 m where the DG storage exceeds 1000 litres. For DG quantities less than 200 litres, SQF separation is determined by the LA. Where the SQF is in a large work area, such as a vehicle, ship or aircraft maintenance facility, it is to be clear of traffic and personnel paths and at least 3 m from incompatible processes and DIR. Unless the SQF is a fixed storage facility or an approved safe, then the SQF location is to be clearly marked on the floor of the facility. This marking should be permanent, but may be by a temporary barrier for SQF that do not continuously contain EO, eg seat storage area.

Quantity Distance Criteria for Small Quantity Facility

13.7 SQF are not normally subject to the Quantity Distance (QD) criteria prescribed in Regulation 5.4 Procedure 1.

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1 Incompatible processes are those that are not directly related to the SQF and that involve use of substances classed as Dangerous Goods (DG), chemical-cleaning processes or hot work. The term includes areas where such substances are used or where they are stored ready for use. It does not include bulk storage of DG.

2 A domestic inhabited room (DIR) is defined as one that is normally occupied by staff not directly related to the SQF, and where numbers of personnel assemble for purposes not directly connected with work activities.

13.8 The determination of SQF QD and the quantities of EO to be held in a SQF, is to be based on an Explosives Risk Assessment (ERA) as detailed in Regulation 5.3 Procedure 1. The LA is to conduct the ERA and determine the appropriate SQF QD and NEQ allowable for each SQF. Because of the complexity of risk assessments and the number of variables to be considered, each SQF case must be assessed individually by the LA, except as provided for at paragraph 13.18. However, for EO of any Hazard Division (HD) and NEQ (up to 50 kg) in a SQF that complies with the QD requirements of Regulation 5.4 Procedure 1, QD siting criteria may be used in lieu of a risk assessment for that HD and NEQ only.

13.9 **Small Quantity Facility as an Exposed Site (ES).** Where the explosive consequences of a Potential Explosive Site's (PES) initiation, and in particular the probability of propagation of the explosion from the SQF is not significantly increased, the SQF need not be considered as an Exposed Site ES when determining QD in accordance with Regulation 5.4 Procedure 1. A SQF occupied by personnel undertaking EO activities is to be treated as an ES in accordance with Regulation 5.4 Procedure 1.

Permitted NEQ and Hazard Division Aggregation in Small Quantity Facility

13.10 The EO that may be stored or processed in a SQF may be of single or mixed HD. The total NEQ of HD 1.1, 1.2 and 1.3 is not to exceed 50 kg and an additional HD 1.4 quantity, up to 50 kg may be permitted by the LA. In exceptional circumstances where it is demonstrated by the user unit to be essential for Defence capability, the LA will determine the additional quantity of HD 1.4S EO (only) that may be stored or processed with EO of other HCC in the SQF.

13.11 EO of HD 1.1 and 1.2, especially fragmenting EO, should not normally be stored in SQF. When the LA permits such storage, on the basis that it is an essential requirement, the licensed quantities are to be kept to the absolute minimum.

Compatibility Mixing in Small Quantity Facility

13.12 Small quantities of EO in Compatibility Groups B, C, D, E, F and S may be stored together in any one SQF. However, EO in Groups G and H are normally to be stored in a separate compartment or SQF. Because of the nature of Group F stores, these should also be considered for separate storage. The LA may specify compatibility mixing requirements on the Explosives Limit Licence.

Construction of Small Quantity Facility

13.13 Justification for the storage or processing of EO outside a designated EO storage area must be agreed by the LA in writing before construction of new SQF can commence.

13.14 Several types of SQF may be required to support an establishment's operational or training role. The construction of SQF must aim to meet the following minimum criteria:

a. If it is a room, a SQF is to be of fire resistant material.

b. SQF licensed for EO storage and/or equipment maintenance (only) are to comply, as far as practicable, with the (electrical) requirements of a Restricted Electrical Area (REA) as defined in Regulation 6.3 Procedure 1 Annex D. All other SQF are to be assessed in accordance with Regulation 6.3 Procedure 1 Annex B, and those found not to be classified as a REA are to be referred to the LA for further advice.

NOTE

Circumstances such as type of use, size, structure and location of SQF may mean full compliance with Regulation 6.3 Procedure 1 Annex D cannot be achieved. Advice on the application of Regulation 6.3 Procedure 1 Annex D is to be sought from the LA. Note that direct EO hazards are to be mitigated. Exemptions to paragraph 13.14 b are to be referred to the Directorate of Ordnance Safety.

c. The SQF must meet the basic security requirements as determined by the responsible security authority.

d. Windows, if fitted to SQF, are to be protected against unauthorised entry as determined by the responsible security authority.

e. Improvised containers may be used in lieu of purpose built lockers and magazines but they are to be made of steel and be large enough to store the required number of items in a safe manner. All lockers and containers are to be secured within a room to a wall, floor, or other substantial structure, unless their bulk and weight, or the physical environs precludes easy removal.

f. Containers sited in the open must be weatherproofed and shielded from direct sunlight where possible.

g. SQF licensed to hold HD 1.1 and 1.2 EO are normally to be internally and/or externally traversed (see paragraph 13.15).

h. A security fence is required for SQF in an open area unless a security assessment, to be conducted by the responsible security authority, determines that it is not required.

i. Lightning protection for a SQF in the open is not normally required in accordance with Regulation 6.2 Procedure 1 paragraph 1.8. However, SQFs that are metal lockers and containers in the open must comply with the earthing requirements of Regulation 6.2 Procedure 1 paragraph 1.8 d.

Traversing and unitisation requirements for Small Quantity Facility

13.15 If SQF are required to be traversed, an internal traverse in lieu of an external traverse may be fabricated using sandbags. EO of HD 1.1 or HD 1.2 is to be stored in units no larger than 5 kg NEQ and a double row of sandbags is to surround the EO. The height of the sand bag wall is to be at least 300 mm above the EO stack. Outer or internal walls of a structure may form part of the traverse provided the walls are brick or concrete. The internal traverse may also be constructed of a double row of bricks, equivalent thickness of reinforced concrete or other suitable sand filled container. Further advice may be sought from the LA. Multi-bay SQF that have effective traversing between bays may, at the discretion of the LA, have each bay licensed in isolation to the other bays. SQF containing HD 1.1 or HD 1.2 may also have an external traverse, but such traverses are to be constructed in accordance with the normal traverse design rules in Regulation 6.1 Procedure 2.

13.16 Certain items are permitted to be stored within an SQF that are exceptions to the 5 kg rule as defined in paragraph 13.15. These items have been approved for storage under the conditions outlined in paragraph 13.15. Items are assessed individually and authorised by the ESTC on request. The authorised items are listed below:

a. Kit Explosive Detection Dog – DEOCL Number P4471.

Licensing of Small Quantity Facility

13.17 SQF are to be licensed by the LA using Form EO 002 Small Quantity Facility Explosives Limit Licence[3] (see Regulation 5.2 Procedure 1).

13.18 **Common Use Small Quantity Facility.** Throughout Defence several types of SQF have been authorised for similar purposes under the same conditions and requirements. The LA has completed an ERA on these types of SQF as required at paragraph 13.8. Applications for SQF licences which meet the criteria in Annex A may be authorised without further risk assessment.

[3] Form EO 002 is available on application using Form AE303

13.19 Safeguarding of Small Quantity Facility. Due to the special requirements and limitations applicable to SQF, and since each SQF is licensed by risk assessment in accordance with paragraph 13.8, SQFs do not require to be safeguarded in accordance with the requirements of Regulation 5.6 Procedure 1. However, the location of SQF are normally annotated on Safeguarding Maps of an EO establishment. Any changes to facilities or new developments occurring adjacent to SQFs, a review of the EO risk hazard assessment previously conducted must be carried out.

Authorisation of SQF

13.20 All SQF are to be authorised for use by the Officer-in-Charge of the unit using Form EO 077 Authorised Use and Explosives Content of an Explosives Facility - See Web Forms for a specimen of Form EO 077. This form promulgates the explosives limits for SQF, up to but never to exceed the limits authorised by the applicable Explosives Limit Licence Form EO 002, and lists the EO and maximum quantities approved to be in the facility, including non-Defence EO.

13.21 Forms EO 077 are to be prepared by the person responsible for the operation of the facility and are to be authorised by the current OIC. Compilation instructions for the form are given by way of notes on the reverse of the form.

NOTE

The use of an Electronic Data Sheet (EDS) may be used to record EO quantities in SQFs with a high turnover of items, in lieu of completing the 'Facility Contents' section of Form EO 077. The EDS must be attached to Form EO 077.

13.22 After approval, Forms EO 077 are to be distributed as follows:

a. The original is to be held in the Explosive Ordnance Facility Authorisation Register - see Regulation 5.2 Procedure 1.

b. One copy is to be displayed adjacent to the Explosive Limit Licence (Form EO 002) for the facility (unless Form EO 002 is not required in accordance with Annex A paragraph 24 of this Procedure).

Display of Licence and Authorisation Form

13.23 Copies of the current licence (if required) and authorisation forms are to be displayed in a prominent position inside or near to each SQF.

Explosives Contents Board

13.24 An Explosives Contents Board prescribed in Regulation 4.4 Procedure 2 is not required for SQF licensed under this instruction.

Fire Prevention and Firefighting

13.25 Attention must be given to ensure that personnel and property are exposed to minimum risk when any outbreak of fire occurs involving, or likely to involve EO. SQF must therefore be protected as much as possible from any risk of fire. Accordingly, the following precautions are to be observed:

a. SQF are not normally to form part of, or be within 3 m of a building or room in which small quantities of flammable goods are stored or used (see also paragraph 13.6).

b. The use of flames or smoking is prohibited within 3 m of SQF. This is to be promulgated in local instructions.

c. A water type fire extinguisher shall be readily available for isolated SQFs and located within 5 m of the SQF. Internal SQF shall have a fire extinguisher located not more than 3 m from the SQF.

d. For SQF that are lockers located in the open, a clear non-grassed area of 1 m is required around the SQF. At a distance of 1 m to 5 m of the SQF, the grass is to be kept short, ie between 50 mm and 300 mm. No bushes, undergrowth or overhanging tree branches are permitted. These requirements may be varied at the discretion of the LA and/or in consultation with the local fire authority.

13.26 Display of Fire Symbols for Small Quantity Facility. Whenever EO is present in an SQF an appropriate fire symbol, including any supplementary fire symbol(s), is to be displayed on the side(s) facing the most likely vehicular or pedestrian approach, as appropriate. The fire symbols may be attached to the SQF or sign-posted a short distance (up to 5 m) from the SQF. These symbols must be changed whenever Hazard Divisions or supplementary risks change. In cases where the NEQ is low (at the discretion of the LA) and only HD 1.3 or 1.4 EO is involved, and the SQF is a room, locker or container within a building or other large structure, eg aircraft hangar, external signage may not be required and only the SQF itself and the door to the room need to have signage. In these circumstances the placement of fire symbols is at the discretion of the LA. Also, there may be occasions where the LA or local emergency authorities require additional signposting and this will be specified on the ELL or in local emergency instructions. Fire symbols are never to be obscured and must be clearly visible at all times. Notwithstanding the above, a unit in a remote location may apply for a concession to the local fire authority if display of fire symbols could draw attention to the storage of EO.

Electrical Hazards

13.27 EO is sufficiently protected from the harmful effects of Electro-Static Discharge (ESD) when it is contained in its approved packaging. Where susceptible explosive material or Electro-Explosive Devices (EEDs) are exposed or being handled, then the requirements of Regulation 6.3 Procedure 2 are applicable.

13.28 EO containing EEDs require protection from RADHAZ in accordance with Regulation 4.4 Procedure 15.

Principles for the Operation of Small Quantity Facility

13.29 SQF are to be in the charge of an appropriately qualified and responsible person who is to ensure the safe custody of the EO at all times. SQF are to be operated in accordance with the following principles. This list is in no way exhaustive and the instructions in Regulation 4.4 Procedure 2 for the operation of EO storehouses in designated EO storage areas also apply where applicable:

a. Drill, dummy or instructional ammunition and weapons are not to be stored with live EO. The only exception to this is when an explosive or inert component is packaged separately from the parent item. Such components may be stored together, eg components of the Grenade Hand Practice F3.

b. Packaged kits, eg Ramset kits, and their components may be stored together.

c. Empty packages are not to be stored in SQF with live EO.

d. For security reasons, fired cartridge cases may be stored in SQF with live EO pending ‘free from explosives’ certification, and provided the cartridge cases are in a sealed container and clearly marked. Such storage is to be for the minimum time required.

e. Handling of EO is to be avoided during the approach or progress of an electrical storm.

f. Only those persons actually engaged in the handling of EO are to be in the immediate vicinity of such operations.

g. For EO of HD 1.1 and HD 1.2, the maximum use of unitisation to reduce external hazards is to be adopted. NEQ for each unitised quantity of EO is not to exceed 5 kg unless approved by paragraph 13.16. Each unitised quantity is to be separated by at least 1 m from another.

h. Only properly packaged EO may be stored in SQF unless otherwise indicated on the licence.

i. Safes are not to be used as SQF except for storage of small quantities of pyrotechnic stores and Small Arms Ammunition (SAA). Safes so used are not to contain any other valuable and attractive items and are not to contain files or documents that would require the safe to remain unsecured for lengthy periods.

j. The storage of SAA in SQF is to be restricted to ammunition that is not of high explosive configuration and below a calibre of 19.1 mm.

k. Ball and blank SAA should be stored in separate SQF, but must be stored in separate compartments that are clearly marked, to reduce the possibility of contamination of blank ammunition with ball rounds.

l. Co-located SQF lockers are to be separated by a minimum distance of 1 m otherwise the NEQ of each SQF are to be aggregated and the lockers licensed as a single site. Relocatable magazines constructed in accordance with AS 2187.1-1998 may have a lesser minimum distance separation requirement from each other or to another SQF without requiring aggregation at the discretion of the LA. The LA may also require increased minimum separation distance to mitigate explosive risks.

m. EO from fraction containers, ie containers having fewer than the recognised full quantity, should always be used first.

n. Unpackaged EO, in particular SAA, is not to be stored in bags. EO that has been issued, and then returned unused, is to be packed into its authorised package before being placed in a SQF for storage.

o. Packages containing EO that have been wetted are to be carefully wiped dry, especially around the lid, before being placed in a SQF. Where the package is suspected or known not to be airtight, it is to be opened and the EO inside inspected and, if necessary, dried carefully item by item.

p. Packages are to be stored in SQF's in such a way that air may be circulated freely around and under them.

q. Dangerous goods other than Class 1 such as paints, oils, chemicals, other dangerous goods and cleaning rags etc are not to be stored in SQF unless they have been allocated a DEOCL number.

r. The issue or receipt of EO, from or to, packages in SQF is permitted provided all packages are subsequently closed (see Regulation 2.3 Procedure 4 paragraph 4.30).

Inspection of Explosive Ordnance in Small Quantity Facility

13.30 The examination of EO in storage SQF or those items removed from equipment undergoing servicing, eg those from life rafts, parachute packs and aircrew vests, is to be visual only. If the inspection involves dismantling, eg the removal of a fire extinguisher cartridge from its bottle assembly, the inspection is to be performed in a licensed SQF EO process facility.

Security

13.31 Establishments should always be aware of the threat of theft of EO and implement security measures for SQF accordingly. The LA may require Defence Security Authority to conduct a security assessment of the SQF in question before a licence is authorised.

Instructions and Emergency Plans

13.32 Establishments are to indicate in standing orders or instructions that SQF are to be managed and operated in accordance with the requirements detailed in this procedure.

13.33 In accordance with Regulation 4.7, establishments with SQF are to ensure that the hazards associated with the explosives contents of such facilities are addressed in the establishment's emergency response plan.

Annex:
A. Common Conditions for Storage of Explosive Ordnance in Small Quantity Facilities

ANNEX A

COMMON CONDITIONS FOR STORAGE OF EXPLOSIVE ORDNANCE IN SMALL QUANTITY FACILITIES

Introduction

1. Under the provisions of Regulation 5.2 Procedure 1 storage and handling areas for small quantities of Explosive Ordnance (EO) may be licensed after a risk assessment has shown that the risk is acceptable. Because of the extremely large number of combinations of quantity and natures of EO, handling activities and physical situations that occur in the handling of small quantities, each situation normally requires an individual risk assessment so that all relevant factors are taken into consideration when determining risk. However, after several years of licensing Small Quantity Facility (SQF), it is apparent that across the three Services there are a number of common scenarios and conditions for handling small quantities of EO that have been risk assessed many times and have been shown to present similar very low levels of risk.

2. The following paragraphs describe those scenarios that are commonly found to occur at numerous sites and that have been shown by risk assessments to be of similar very low levels of risk. The descriptions contain the natures of EO that may be handled, where relevant the Net Explosive Quantity (NEQ) permitted and any special conditions that are to apply to ensure that the scenario is within the limits of previous risk assessments. Where a handling scenario complies with one or more of the following descriptions it is to be licensed, but an individual risk assessment is not necessary. Scenarios that do not meet the following descriptions may also be licensed, but these require risk assessments to be carried out to the satisfaction of the Licensing Authority (LA).

Metal Lockers and Containers

3. Metal lockers and containers, of any size appropriate for the quantity of items held, are suitable containers for EO from a security and explosives safety point of view. Where metal lockers or containers are prescribed for storage in scenarios described in the following paragraphs of this annex the following conditions are to apply:

a. It is to be painted white if practicable.

b. The word EXPLOSIVES in red lettering, a minimum of 25 mm high, is to be visible from the most common approach routes. Paint, sticker, decal or other reliable form of marking is acceptable.

c. The appropriate fire class symbol, and if necessary supplementary fire symbol, is to be fixed so as to be visible from the most common approach routes. These symbols should be fixed to the locker or container, but may be attached to a nearby structure. Advice may be sought from the local Fire Authority.

d. It is to be of solid steel construction with welded seams, tamper-proof hinges and a tamper-proof locking system.

e. The key or combination is to be under the positive control of a designated, responsible person. A register of names of current designated persons is to be maintained by the establishment's Explosives Custodian Officer (RAN) or Base Armament Manager (RAAF) and by the Executive Officer of Australian Regular Army, Reserve and Cadet Units.

Designated Containers and Structures

4. In addition to metal lockers and containers prescribed at paragraph 3, the following propriety containers and magazines are designated as suitable for use as an SQF:

a. A or B class safe.

ANNEX A

b. Relocatable Magazines built to AS 2187.1-1998.

c. Purpose built Enhanced Self Defence Capability (ESDC) lockers.

d. Masonry magazines, armouries and enclosures fitted with Defence Security Authority approved doors and locks.

e. ISO and Tricon type shipping containers.

5. The conditions at paragraph 3c and e above are to apply to designated containers and structures. Safes are suitable for SAA, smoke producing EO and some other pyrotechnics as determined by the LA.

Storage of SAA and Pyrotechnics

6. All storage facilities approved by this Annex are suitable for storage of HD 1.4 SAA, smoke producing EO and most other pyrotechnics as determined by the LA. Approved NEQ and HDs will depend on facility dimensions and location.

Ready Use Stocks of Installed Explosive Ordnance[1]

7. Platform and component servicing or maintenance areas are often used to remove and replace items of installed EO. To maintain efficient operations it is acceptable for such areas to store small quantities of EO. The installed EO that has been removed and serviceable EO awaiting installation may be stored together, but the quantity stored is not to exceed that normally resulting from two working weeks of operations. The storage container is to have a physical barrier to create separate compartments for storage of unserviceable and serviceable EO as the requirements of Regulation 4.1 Procedure 1 paragraph 1.14 still apply in this scenario. Each compartment is to be clearly marked to indicate the status of items within. The storage facility is to be in accordance with this Annex. The area where EO is removed from the platform is normally not required to be licensed, but maintenance areas for components containing EO are to be licensed. See below for conditions for electrically initiated cartridges.

Areas for Maintenance of Components Containing Electrically Initiated Cartridges

8. Maintenance of components containing electrically initiated cartridges is to be carried out in a licensed site within a workshop or hangar. The licensed site includes the work area and the approved EO storage facility. Components, either with or without cartridges, may be stored with new and time-expired cartridges in the approved EO storage facility. However, each category of article is to be in a separate, clearly marked compartment. The requirements of Regulation 4.4 Procedure 8 paragraphs 8.21 to 8.26 are to apply.

Ammunitioning of Ships

9. Provided main magazines are not accessed, any wharf may be licensed for handling pyrotechnic items that make up a ship's navigation outfit, smoke generators required for crew work-up and proficiency training or testing, and SAA for ship's staff individual weapons. The EO is to be stowed in an approved EO stowage that does not contain main gun ammunition, torpedoes or guided weapons. After the ship sails the EO may be moved into another magazine if required. The following risk minimisation measures are to be implemented:

a. All non-EO gangway activity is to cease while ammunition is being transferred.

b. Ammunitioning is not to occur in conjunction with fuelling or handling of other dangerous goods.

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[1] Installed EO is EO that is always fitted to a weapon platform for its function and/or safety of operation, eg fire extinguisher/cable cutter/ejection seat cartridges.

c. EO handling personnel are to be afforded direct, unhindered access between the wharf and the EO stowage onboard.

d. The EO delivery vehicle is a potential source of fire and, consequently, EO initiation. Suitable fire suppression equipment is to be immediately available to douse a vehicle fire.

e. The EO delivery vehicle is to be parked as close as practicable to the gangway. However, a minimum safety distance of 10 m should be observed between the delivery vehicle and inhabited facilities. In some instances, a parking position will be annotated on the licence.

f. No smoking or mobile phones or transmitters are permitted within 3 m of the delivery vehicle and the ship's access route.

Conditions of Storage for Ejector Cartridges

10. Small quantities of ejector release unit cartridges held for ready-use purposes, up to 3 kg NEQ, may be stored in an approved EO storage facility.

Conditions of Storage for Aircraft Ejection Seats (Without Rocket Motors)

11. Complete ejection seats, including seat sub-assemblies, removed from aircraft that contain cartridge actuated devices of any HD (but not rocket motors) are normally to be placed in a separate licensed EO storage facility. However, an area may be designated in a licensed workshop or hangar area. The number of seats that are held in this area is to be the minimum required to meet maintenance requirements. When in use the designated area and individual seats are to be placarded with a warning sign that is visible to all persons who may approach it. The warning sign is to have the following notice stencilled in 25 mm red letters on a white background:

Conditions of Storage for Aircraft Ejection Seats fitted with Rocket Motors

12. When complete ejection seats or seat sub-assemblies, with rocket motors attached are removed from aircraft, the seats, sub-assemblies or detached rocket motors are normally to be removed to the EO storage area or other approved purpose built EO storage facility that is appropriately licensed. Paragraph 15 outlines the requirements for a purpose built facility. It is preferred that rocket packs be removed from the seat and stored individually in OEM packaging or in accordance with the Topic -025 of the item publication. The seat may then be stored under the conditions of paragraph 11. However, for efficiency of maintenance operations, storage of ejection seats fitted with rocket motors may be stored in a licensed workshop or hangar area for a period not to exceed 24 hours.

Conditions of Storage for Aircraft Canopy (Without Rocket Motors)

13. Aircraft canopies removed for maintenance or replacement and fitted with explosive transfer lines[2] (but not rocket motors) may be moved to an EO storage area located in a workshop or hangar that is appropriately licensed for that activity. Canopies and components are to be stored on suitable racks or stands or in containers designed for the storage of the particular item. The number of canopies held in this area is to be the minimum required to meet maintenance requirements. The designated area is to be placarded with a warning sign that is visible to all persons who may approach

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[2] Shielded Mild Detonating Cord (SMDC), Thin Line Explosive (TLX), Flexible Confined Detonating Cord (FCDC).

it. The warning signs are to have the following notice stencilled in 25 mm red letters on a white background:

Conditions of Storage for Aircraft Canopies fitted with Rocket Motors

14. When a canopy with rocket motors installed is removed from an aircraft, the canopy is to be moved to a licensed area in a workshop or hangar. It is preferred that rocket motors are removed from the canopy and stored individually in an approved EO storage facility within the OEM packaging or in approved packaging in accordance with the Topic - 025. When the canopy rocket motors are removed, the canopy is then to be stored under the conditions of paragraph 13. However, for efficiency of maintenance operations, storage of canopies fitted with rocket motors may be stored in a licensed workshop or hangar area for a period not to exceed 24 hours.

Design Principles of a Purpose Built Rocket Motor Storage Facility

15. Where construction of a purpose built rocket motor storage facility is contemplated, or use of a suitably modified existing facility, the following design principles are to apply:

a. The primary aim in the event of an accidental rocket motor initiation is to contain the seat and all its components[3].

b. Rocket efflux is to be vented safely without endangering personnel, assets or facilities. A 1 m clear zone is to be designated around the facility.

c. Projection of building debris is to be minimised and is not to present a hazard to nearby personnel, assets or facilities.

d. Appropriate security and fire prevention measures are to be incorporated.

e. The separation distance of the EO storage facility from the Commonwealth property boundary is to be at the discretion of the LA, but must comply with security requirements.

16. Any design concept meeting the above principles is acceptable. Design packages are only to be forwarded to the LA for design consideration once the final design certificate has been provided by the designated authority.

Conditions of Storage for SAR Equipment Sets, Life Rafts, Survival Packs and Flying Clothing Containing Pyrotechnics and Matches

17. Some items of survival equipment containing pyrotechnics and matches are classified as Dangerous Goods (DG), but not Class 1. Where this is the case, the items are to be stored in accordance with requirements for their DG Class. Where the items are Class 1, they must be stored in a licensed work and maintenance areas in a site that meets the requirements for siting of an SQF. Areas where items of any DG Class are maintained, and EO items are removed or fitted, are to be licensed. The general requirements for siting SQF apply. New EO items, sufficient for ready use requirements, and time expired EO items, may be stored together in an approved licensed storage facility in the maintenance section provided they are separated from each other within the storage facility.

18. Flying clothing containing survival pyrotechnics and matches may be stored in either of the following conditions:

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[3] Includes canopy rocket motors

a. In open racks in an acceptable and authorised flying clothing SQF.

or

b. In the aircraft cockpit and treated as installed EO with no ELL required, providing the following conditions are met:

(1) There is no authorised or acceptable flying clothing storage SQF within the location.

(2) Authorisation is required from the Unit CO after consultation with the Airfield Manager/equivalent.

(3) Maintenance is not to be conducted on the flying clothing, only visual inspection not involving dismantling permissible.

(4) Adequate aircraft/airfield security is to be provided.

(5) Period of storage is not to exceed 72 hours.

Conditions for Temporary Storage of Practice Bombs, Ball Ammunition, Chaff and Flares

19. Practice bombs, ball ammunition and countermeasures held ready for loading to aircraft during turnarounds, may be held in temporary storage (eg trolley) in selected licensed and authorised areas convenient to the aircraft dispersals. The areas are to be at least 25 m from all buildings, installations and aircraft not involved in the EO operations. The area is to be clearly marked with warning signs and red flags. The amount of EO so stored is not to exceed that required for one day, and cannot exceed 50kg in total.

Conditions for Storage of Towed Target System Explosive Bolts

20. Explosive bolts and release link assemblies from the Towed Target Release System may be stored in the banner preparation room in an approved licensed storage facility.

Conditions for Storage of Matches

21. Matches safety or matches non-safety may be stored in a SQF provided that they are packed separately in a metal ammunition box. If the SQF is a room, the matches are to be held in a metal cupboard.

Conditions for Storage of Enhanced Self Defence Capability Explosive Ordnance

22. The EA may approve deviation from some compliance requirements of the DEOP 101 and determine that SAA ammunition, in approved storage configurations and quantities, may be stored in dedicated ESDC lockers with weapons and related equipment.

Exercise, Practice and Telemetry Explosive Ordnance

23. Exercise, practice and telemetry EO that is classified as HD 1.4 may be handled without the need to apply QD. Movement of these items into or out of ship's magazines and armoured vehicles, and loading onto aircraft, does not pose a significant risk to other EO already accommodated provided the other EO is not being handled. Accordingly, it is not normally necessary to count the NEQ of the already-loaded EO in the handling activity. However, if other natures of EO are required to be moved or handled to facilitate this evolution, then normal application of QD for the total EO contents of the platform is required. The following risk minimisation measures are to be implemented:

a. All non-EO activity is to cease while ammunition is being transferred.

b. Ammunitioning is not to occur in conjunction with fuelling or handling of other dangerous goods.

c. EO handling personnel are to be afforded direct, unhindered access between the EO delivery point and the EO storage on the platform.

d. The EO delivery vehicle is a potential source of fire and, consequently, EO initiation. Suitable fire suppression equipment is to be immediately available to douse a vehicle fire.

e. No smoking or mobile phones or transmitters are permitted within 3 m of the delivery vehicle.

24. The maintenance and storage of these items within designated facilities, movement into and out of ship's magazines and armoured vehicles, and loading onto aircraft does not pose a significant risk to other EO already accommodated provided the other EO is not being handled.

Very small quantities of HD 1.4 EO

25. Very small quantities of HD 1.4 EO, up to a total NEQ of 0.01 kg, may be stored and handled in an SQF without the need for an explosive limit licence provided that:

a. Item(s) have a DEOCL number.

b. Items are held in approved packaging or parent assembly when not being handled.

c. Explosive Risk Assessment (ERA) shows that the item(s) are unlikely to cause the subsequent initiation of other hazardous materials, significant damage to equipment or injury to personnel.

d. Does not apply to detonators and items of HD 1.4D.

Notes:

A form EO 077 and appropriate explosive, fire and PPE signage is still required for EO stored and/or handled under the conditions of this paragraph.

The requirements of Regulation 6.3 do not apply to SQF approved under conditions of this paragraph.

PROCEDURE 14 - TRANSFER OF EXPLOSIVE ORDNANCE

Introduction

14.1 The transfer of Explosive Ordnance (EO) whether onto a road vehicle, ship, watercraft, or aircraft exposes it to a higher level of risk than most other operations. It is therefore important that the appropriate policies and responsibilities be promulgated to ensure maximum safety and efficiency during these transfer operations.

Purpose

14.2 This procedure prescribes the policies applicable to the transfer of EO.

Transfer of Explosive Ordnance

14.3 Transferring EO is the process involving the movement of EO from one place to another using any form of transport or Mechanical Handling Equipment (MHE). This process is to occur at a site that is licensed as an approved EO transfer facility.

GENERAL

Responsibilities – General

14.4 The Commanding Officer (CO) or duly authorised civilian equivalent of the unit/organisation involved in EO transfer operations is responsible for ensuring that:

a. Detailed local operating procedures are prepared, based on this procedure, and that staff involved in the operations are conversant with them; and

b. An officer/supervisor is appointed to be responsible for each EO transfer operation and that his/her duties and responsibilities are included in the local operating procedures.

Local Procedures for Defence Establishments

14.5 Detailed local procedures, authorised by the CO or official delegate who has command responsibility of the EO transfer site on a Defence establishment or which is under the control of Defence, are to be prepared covering all aspects of local EO transfer operations. As a guide, a list of topics that should be considered when drafting local procedures is given in Annex A. Specialist advice to assist in the preparation of these procedures should be sought from the Commanding Officer, Joint Explosive Ordnance Services (JEOS).

Local Procedures for Commercial Sites

14.6 At commercial sites EO transfer operations are to be undertaken in accordance with local procedures authorised by the Site Manager. These procedures are to meet the minimum Defence requirements specified in this procedure.

Security

14.7 Security practices required to be undertaken during the transfer of EO are detailed in the Defence Security Principles Framework (DSPF).

Logistic Paperwork

14.8 The logistic paperwork, such as EO Demand Requests (AC 665) or Ammunition Issue Record (SQ 080) etc., which is required to accompany the EO when being moved is detailed in the Electronic Supply Chain Manual (ESCM), V04S08C01 – Management, Accounting and Assurance of Explosive Ordnance at Unit Level

14.9 The EO User Guide produced by DEOS detail processes and procedures that are required when interacting with the EO Services Provider. The EO User Guide is available on the ESCM, V04S08C01.

Handling of Explosive Ordnance

14.10 Care is to be taken at all times when handling EO. In particular, the following precautions are to be observed when lifting EO during transfer operations:

a. Lifting equipment is to be used in accordance with its user instructions.

b. The route used in the transfer is to be planned to ensure it passes over the minimum number of dangerous projections as possible and is clear of obstructions such as parked trolleys or containers, empty pallets, etc.

c. Items are to be lifted no higher than is necessary to clear obstructions (see also paragraph 14.11).

d. Where practicable, loads are not to be traversed over EO or personnel. Guide ropes are be used if the lift is sufficient height to require them.

e. Packages, pallets, cages etc are only to be slung by the specified points and using the equipment authorised for the particular task.

f. Packages are not to be slung by their handles.

Maximum Lifting Heights

14.11 As a result of the reaction of certain items of EO to drop testing some items have been allocated a Maximum Lifting Height (MLH), sometimes known as safe lifting height. These MLH are specified in item publications and are to be observed at all times. Where a MLH is not specified, the maximum height lifted is to be limited to a MLH of 12 m (40 ft). The requirements of paragraph 14.10b should always be the basis of any lifting operations.

Lifting and Handling Equipment

14.12 Lifting and handling operations are only to be undertaken using equipment that is within the prescribed test period. Special purpose lifting and handling equipment is not to be used for other applications unless specifically authorised by the OIC.

Defective and Damaged Explosive Ordnance

14.13 Any damaged, defective, misfired, malfunctioned or suspect EO is not to be included in an EO transfer operation until it has been examined and a Certificate of Safety provided in accordance with Regulation 3.1 Procedure 2. If an authorised inspector is not prepared to provide a Certificate of Safety, the EO is not to be transferred and local Explosive Ordnance Disposal (EOD) staff is to be called to deal with the EO. Defective and damaged EO is to be reported in accordance with Regulation 1.3.

Authenticity Sealing of Packages at the Point of Exchange

14.14 When EO packages are received at the exchange site with broken seals and the inner packages without seals are not damaged and interference with the contents is not suspected, the contents may be examined and the packages sealed by an appropriately qualified and authorised person detailed in Regulation 2.3 Procedure 3. Should damage or interference be suspected, the incident is to be reported in accordance with Regulation 1.3.

Authenticity Sealing of 'Broken Seal' Packages during Transfer of Explosive Ordnance

14.15 So as to comply with *Explosives Transport Regulations 2002 Statutory Rules No. 92, 2002* (ETR), packages with broken seals are not to be transported on public roads or waterways. Hence, unsealed or incomplete packages of EO which do not carry valid seals are to be checked for visual serviceability, that external safety devices are fitted and that the EO is properly packed in its authorised packages. The packages are then to be authenticity sealed as required at Regulation 2.3 Procedure 3. This activity is to be completed by an appropriately qualified and authorised person Incompatible activities, such as re-fuelling and Radio Frequency (RF) transmissions, are to be controlled or restricted during this time and appropriate fire precautions are to be in place.

14.16 **Operating Instructions.** Appropriate arrangements to mitigate any risks associated with the inspection and authenticity sealing of broken seal packages, permitted at paragraphs 14.14 and 14.15, are to be detailed in local operating instructions.

Lightning Risk Conditions

14.17 Responsibilities and actions relating to lightning risk condition occurring during EO transfer operations are set out in Regulation 4.4 Procedure 1.

Firefighting Equipment

14.18 The positioning and state of readiness of this equipment for EO transfer operations is the responsibility of the authority that has command responsibility of the facility, and these requirements are to be detailed in local standing instructions.

Requirements for Transfer of Explosive Ordnance at Wharves and Anchorages

14.19 Additional requirements for transferring EO at wharves and anchorages are detailed in Annex B.

Annexes:
A. Checklist for Preparing Local Operating Procedures
B. Additional Requirements for Transfer of Explosive Ordnance at Wharves and Anchorages

ANNEX A

CHECKLIST FOR PREPARING LOCAL OPERATING PROCEDURES

1. Below is a list of topics that should be addressed when drafting local procedures relating to Explosive Ordnance (EO) transfer operations. The list is intended as a guide and as such not all topics may be relevant to each transfer operation. Developers of local operating procedures are to tailor the following topic list to suit their requirements:

a. Access/Control of Personnel.

b. Adverse weather conditions.

c. Attendance of Specialist Staff.

d. Broken Seal Containers.

e. Competencies and Authorisation of Personnel.

f. Control of EO Stores.

g. Control of Expended EO.

h. Control of Empty Packages.

i. Control of Material Handling Equipment.

j. Crane Operations.

k. Damaged/Defective Stores.

l. Duties of Personnel.

m. Emergency Procedures.

n. EO Transfer Operations.

o. EO Mixing Limitations.

p. EO Accounting Procedures.

q. Explosives Licence Limits.

r. Firefighting Requirements.

s. Incompatible Operations.

t. List of authorised lifting and handling equipment.

u. Loading/Unloading Plan including Launcher Alignment checks.

v. Locality of nearest licensed site.

w. Mooring arrangements and Operations.

x. Non–explosives Transfer Operations.

y. Precautions During Lifting.

z. Pre-operations Conference.

ANNEX A

aa. Preparation of Wharf for EO Transfer Operations.

bb. Radiation Hazards Aspects.

cc. Security/Control during Silent Hours.

dd. Use of Shot Mats etc.

ee. Vehicle Authorisation and Control.

ff. Wharf Limitations.

gg. Calibration of gauges, lifting appliances etc.

hh. Personal Protective Clothing and Equipment.

ANNEX B

ADDITIONAL REQUIREMENTS FOR TRANSFER OF EXPLOSIVE ORDNANCE AT WHARVES AND ANCHORAGES

Introduction

1. The transfer of Explosive Ordnance (EO) at wharves and anchorages, whether onto a road vehicle, ship or watercraft, exposes it to a higher level of risk than most other operations. It is therefore important that the appropriate policies and responsibilities be promulgated to ensure maximum safety and efficiency during these transfer operations. In the context of this annex the requirements for wharves also apply to piers or jetties.

Purpose

2. This annex prescribes the policies and responsibilities applicable to EO transfer operations at wharves and anchorages, in addition to the procedures detailed in Procedure 14, when the transfer operations involve HMA Ships and Submarines and other military watercraft, foreign military vessels and commercial vessels loading/unloading Commonwealth EO. This annex is to be read in conjunction with ABR 862 Volume 2, Chapter 5.

Explosive Ordnance Transfer Operations

3. An EO transfer operation is the process of moving EO from one place to another using any form of transport or Material Handling Equipment (MHE). In the context of this annex an EO transfer operation involves the movement of EO onto/over a wharf to/from a transport vehicle/transport watercraft/ship/MHE and includes ship to ship transfers at wharves and anchorages. The use of the term ammunitioning is restricted to the movement of EO to or from a ship (see ABR 862 Volume 2, Chapter 5).

4. Except for the transfer of small quantities of pyrotechnic EO such as a navigational outfit, the transfer or replenishment of EO between ships is prohibited when one of the ships is also involved in transfer operations at wharf-side or at anchorage.

SPECFIC RESPONSIBILITIES OF STAFF INVOLVED IN TRANSFER OF EXPLOSIVE ORDNANCE

Ship's Staff

5. The general responsibilities of ship's staff are set out in ABR 862 Volume 2, Chapter 5.

Shore Organisation's Staff

6. The Officer-in-Charge of the shore organisation's staff at EO transfer operations is responsible for the control, coordination and safety aspects of those operations as set out in this manual. Specific responsibilities are as follows:

a. Ensure that the ship is at its allocated buoy/buoys, anchorages or is in its correct berthing position at a wharf in accordance with approved licence conditions.

b. Ensure arrival at shipside prior to operations commencing and scheduled planned operations are confirmed.

c. Ensure that operations are conducted in accordance with relevant Operating Procedures, including:

(1) Fire hoses charged and ready for use.

(2) Fire hoses ready on Crane Stores Lighter (CSL), where applicable.

(3) No smoking piped.

(4) Appropriate flags displayed by ship.

(5) The ship's RADHAZ Board correct and locked.

(6) EO transfer operations and re–fuelling activities do not take place simultaneously.

(7) Loaded lighters/trucks staged/parked correctly observing appropriate separation distances.

(8) Non–essential personnel vacated.

(9) Appropriate and minimum staff numbers in position at transfer points.

(10) Appropriate lifting methods utilised for each type of EO or unit load.

(11) Appropriate Personal Protective Equipment worn by personnel.

(12) Ensure NEQ limits for lighters/trucks not exceeded and that loaded lighters/trucks correctly placarded.

(13) Ensure Emergency Response Control Plan in place.

Regional Explosives Ordnance Services Staff

7. At all sites where Regional Explosive Ordnance Services (REOS) are established, representatives are to attend all operations involving the transfer of Commonwealth EO to or from HMA ships and submarines and other military watercraft, and foreign military vessels. At sites where REOS are not established, the Explosives Custodian Officer of the sponsor establishment is to provide support.

8. In accordance with ABR 862 Volume 2, Chapter 5, REOS staff attending EO transfer operations are to provide specialist technical advice and assistance on all aspects of EO and to act as safety observers. The core responsibilities prescribed in ABR 862 Volume 2 are amplified at paragraphs 9 to 11. In the event that a foreign warship is involved in the EO transfer operation the safety observer has the additional responsibility to ensure that Australian law and the EO licence conditions applying to that EO transfer site are not breached.

9. **Embarkation.** REOS in attendance at embarkation are responsible for:

a. Providing assistance to ship's staff in accordance with ABR 862 Volume 2, Chapter 5.

b. Sentencing of guided weapons, as required, and providing Certificates of Safety for damaged EO (see Regulation 3.1 Procedure 2).

c. Providing advice to the ship's Commanding Officer (CO) should an incident involving EO occur.

d. Safety observation, (see paragraph 11).

10. **Disembarkation.** REOS in attendance at disembarkation are responsible for:

a. Visual examination to assess the ongoing certification of guided weapons in accordance with local procedures, to allow re–issue to the fleet without further inspection and sentencing by delegated personnel within Authorised Maintenance Organisation (AMO) maintenance facilities.

b. Examination, identification and labelling of suspect, defective, damaged or malfunctioned/misfired EO requiring special attention or priority examination and/or maintenance at the receiving depot. Certificates of Safety are to be issued when required, (see Regulation 3.1 Procedure 2).

c. When applicable, examination and sealing of broken seal packages for suspect EO and guided weapons.

d. Provision of advice and assistance to the ship's CO and the shore organisation's staff should any incidents involving EO occur during the operation. The services of an EOD team should be sought by REOS whenever an EO incident leads to immediate disposal requirements, i.e. a Certificate of Safety cannot be issued.

e. Safety observation, (see paragraph 11).

11. **Safety.** The responsibility for the safe conduct of EO transfer operations rests with both the relevant CO of the ship and of the shore organisation's staff. Whilst on board REOS staff are responsible to the ship's Senior EO Safety Officer (SEOSO) and are to act as safety observers. During EO transfer operations any observed unsafe practices are to be immediately reported to the CO of the particular ship's ammunition group, or the CO of the shore organisation's staff, as appropriate, who is to ensure that the unsafe practice is corrected before operations continue. The REOS' safety observer is to provide advice as to the best course of action if an EO incident occurs and to continue to assist the ship's staff until the EO incident is resolved or the safety observer is relieved by EOD personnel.

12. **Inspection and Sentencing.** All inspection and sentencing of EO is to be conducted in accordance with authorised procedures.

13. **Authorisation of Personnel.** All personnel attending EO transfer operations in an official capacity are to be authorised for the task.

WHARVES

Electrical Standards

14. Wharves are not regarded as EO facilities for the purpose of determining electrical standards. The possibility of fire in such situations is still a great hazard, but as far as electrical causes are concerned it can be taken care of by well–installed and carefully maintained equipment of good commercial quality. However, special attention is to be given to the apparatus installed in the open at or near deck level, especially near the sides of a wharf where the possibility of damage from the movement of vehicles, vessels or cargo must be borne in mind. It is essential therefore, that the importance of installation of correct equipment, protection against the elements and good maintenance cannot be over-emphasised.

15. Fixed cranes are to be bonded to earth in accordance with Regulation 6.2 - Lightning Protection. Mobile cranes must be fitted with appropriate earthing systems if required to lift EO in configurations susceptible to electrical and electrostatic discharge.

Firefighting Equipment at Wharf Areas

16. At initial design, firefighting equipment for wharf areas is to be determined by specialist fire staff.

17. Thereafter, the positioning and state of readiness of this equipment for EO transfer operations is the responsibility of the authority that has command responsibility of the facility, and these requirements are to be detailed in local standing instructions.

18. At EO transfer operations, all aspects associated with the use of firefighting equipment, including training, is the responsibility of the OIC of the shore organisation undertaking the transfer operations.

Licensing

19. Wharves used for EO transfer operations are to be licensed in accordance with Regulation 5.2 Procedure 1.

ANNEX B

ANCHORAGES

20. EO transfer operations at anchorages are to be conducted only at licensed sites. Transfer operations at such sites are to accord with the requirements of ABR 862 Volume 2, Chapter 5.

PROCEDURE 15 - PROCEDURES FOR THE MANAGEMENT OF RADHAZ TO ORDNANCE

Introduction

15.1 A large proportion of the ADF's munitions and explosively actuated systems employ Electro-Explosive Devices (EEDs). An EED is a discrete device that contains an explosive, propellant or pyrotechnic material, which is designed to be initiated by the application of an electrical impulse of specified value and duration. EEDs are therefore unavoidably susceptible to initiation by the application of a specified amount of electrical energy, regardless of its source.

15.2 One of the advantages of EEDs is that they can be designed so that the required amount of electrical energy for initiation is beyond that normally encountered in the natural world. However, certain extremes of the natural environment and many man-made electrical environments are capable of providing the electrical energy necessary to initiate EEDs. Electro-Explosive Hazards (EEH) are those hazards which have the potential to cause inadvertent initiation of EEDs by the application of unintended electrical stimuli. Devices which employ EEDs, known as electrically initiated devices, must therefore be specifically designed to minimise the risk of inadvertent initiation posed by various sources of electrical energy, while maximising their ability to be initiated, when commanded, by the deliberate application of electrical energy to the firing circuit. The risk of inadvertent initiation must be further mitigated by controlling the usage of electrically initiated devices within their operating environment, and by controlling the use of man-made sources of electrical energy which may impact on the safe, reliable operation of electrically initiated devices.

15.3 The sources of EEH are:

a. Inadvertent application of power, including the effects of Electromagnetic Interference (EMI);

b. Radiation Hazards (RADHAZ) to Ordnance;

c. Electrostatic Discharge (ESD), including precipitation static (p-static);

d. Lightning;

e. Electromagnetic Pulse (EMP);

f. Transient Radiation Effects on Electronics (TREE); and

g. Magnetic Fields.

15.4 These hazards, and the requirements for managing the associated risks, are explained in detail in DEOP 115(AM1) *Defence Electro-Explosive Hazards Manual*. A brief description of the most common of theses hazards is provided in the following paragraphs.

15.5 **RADHAZ to Ordnance.** Electromagnetic radiation poses a hazard to electrically initiated devices, as electromagnetic waves with frequencies in the RF spectrum have the ability to couple with EED firing circuits. If sufficient energy is coupled to these leads, electrical energy sufficient to initiate or dud the EED can be generated. In nature, there exists a natural background level of RF radiation, however, in most places; this level is far exceeded by emissions from man-made RF emitters. The RF spectrum is widely used both for civilian and military purposes, and is occupied by emissions from systems as diverse as large, powerful surveillance radars, powerful radio broadcast stations and small portable communications devices such as mobile phones and combat radios. Furthermore, the output power and efficiency of RF emitters is increasing, while their size is decreasing, making control of the electromagnetic environment around electrically initiated devices more difficult. Control of the RF environment to manage RADHAZ to Ordnance is in most cases achieved by ensuring there is an adequate safe distance between RF emitters and electrically initiated devices. Safe distances to manage RADHAZ to Ordnance are provided in this Procedure.

15.6 ESD. ESD poses a considerable hazard to electrically initiated devices, as electrostatic build-up is an unavoidable hazard of both the natural and man-made environment, and has the ability to transfer significant amounts of electrical energy when discharged. ESD can pose a significant hazard if not considered during the design stage of any electrically initiated device. Even when electrically initiated devices include design features to minimise the risk posed by ESD, precautionary procedures are necessary to reduce the risk to an acceptable level. These procedures are provided in Regulation 6.3 Procedure 2.

15.7 Lightning. Lightning is a form of electrostatic discharge worthy of separate consideration, due to the exceptionally large amounts of electrical energy transferred during a lightning strike. Lightning strikes not only transfer large amounts of electrical current, but also generate significant electromagnetic fields in the vicinity of the strike, which can also pose a hazard to electrically initiated devices, even if not struck directly by lightning. The procedures for the protection of EO from lightning are provided at Regulation 6.2 Procedure 1.

RADHAZ to Ordnance Environments

15.8 ADF Baseline RADHAZ to Ordnance Environment. The RF environment against which electrically initiated devices are assessed in the ADF is known as the ADF Baseline RADHAZ to Ordnance Environment. The ADF Baseline RADHAZ to Ordnance Environment is an extreme level likely to be encountered by EO containing EEDs throughout the lifecycle known as the Manufacturer to Target or Disposal Sequence (MTDS), including transport and storage. However, the field strength defined by the ADF Baseline RF Environment may be exceeded in close proximity to RF emitters.

15.9 ADF Restricted RADHAZ to Ordnance Environment. Where personnel are interacting with EO during handling, loading and unloading activities there is a requirement to reduce the RF exposure levels because of the possible increase in coupling RF energy into EEDs, and to protect personnel from the harmful effects of RADHAZ. This reduced RF environment is known as the ADF Restricted RADHAZ to Ordnance Environment.

15.10 ADF RADHAZ to Ordnance Susceptible Environment. Whenever EO is considered susceptible to the ADF Baseline RADHAZ to Ordnance Environment and the magnitude of the susceptibility is unknown, the RF environment must be limited to the ADF RADHAZ to Ordnance Susceptible Environment. This is the minimum RF environment in which the risk to all serviceable ADF EO in the all up round configuration can be considered acceptable.

15.11 ADF RADHAZ to Ordnance Unsafe Environment. There are situations where the protection from RADHAZ due to the munition design is compromised and the likelihood of coupling RF energy into EEDs or firing circuits is significantly increased. In these instances, the RF environment must be reduced to an extreme minimum known as the ADF RADHAZ to Ordnance Unsafe Environment. Exposure is to be limited to this environment if EO containing EEDs are found in the following configurations:

a. The EO internal wiring is exposed by anything other than by design.

b. Tests are being conducted on the EO that results in additional electrical connections to the EO, unless the test configuration has been subjected to a RADHAZ assessment.

c. EEDs having unshielded wire leads are present, handled, or loaded in any but their assessed/tested condition eg, those damaged during an incident. Note that demolition detonators are assessed by assuming the use of unshielded firing lines.

d. The EO is being assembled or disassembled unless this configuration has been subjected to a RADHAZ assessment.

e. The EO has been damaged causing exposure, or possible exposure, of internal wiring or components, or destruction of RADHAZ protective devices such as RF gaskets.

f. Or when specified in EO Item Publication Topic – 027.

15.12 The RADHAZ to Ordnance environments are defined in detail in DEOP 115(AM1) *Defence Electro-Explosive Hazards Manual* and are depicted as tables of power density versus frequency.

RADHAZ to Ordnance Classifications

15.13 EO in service with the ADF is classified in accordance with its ability to withstand exposure to the ADF Baseline RADHAZ to Ordnance Environment. The RADHAZ to Ordnance classification system is therefore independent of platform-specific electromagnetic environments. The RADHAZ Classification of all ADF EO containing EEDs is published in EO Item Publication Topic – 027. There is no requirement to classify percussion fired EO, as RADHAZ is not a credible threat to such EO.

15.14 **ADF RADHAZ to Ordnance SAFE.** When trials or assessment proves EO is able to withstand the ADF Baseline RF Environment, the EO is classified as ADF RADHAZ to Ordnance SAFE (or RADHAZ Safe). It is important to note that the RF environment may exceed the ADF Baseline RADHAZ to Ordnance Environment in close proximity to emitters, and safe distances will be required.

15.15 EO that has been proven safe in the ADF Restricted RADHAZ to Ordnance Environment during the handling and loading/unloading exposure scenarios has a low probability of inadvertent initiation since for the protection of personnel from the harmful effects of radiation, the RF environment must be kept below the ARPANSA RPS No3 Maximum Exposure Levels to radiofrequency Fields – 3 kHz to 300 GHz limits which are lower or similar to the ADF Restricted RADHAZ to Ordnance Environment.

15.16 **ADF RADHAZ to Ordnance SUSCEPTIBLE.** EO that is classified as ADF RADHAZ to Ordnance Susceptible (or RADHAZ Susceptible) has been proven to be adversely affected when exposed to the ADF Baseline RADHAZ to Ordnance Environment. The EO susceptibility is expressed as the maximum safe power density versus frequency, and is published in EO Item Publication Topic – 027.

15.17 **ADF RADHAZ to Ordnance UNSAFE.** EO found in the configurations at paragraph 15.11 are classified as ADF RADHAZ to Ordnance Unsafe.

RADHAZ TO ORDNANCE SAFE DISTANCES FOR GENERAL USE TRANSMITTERS

15.18 The following safe distances have been developed in accordance with DEOP 115(AM1) *Defence Electro-Explosive Hazards Manual*. The basis for the safe distances is EO Div Design Report RADHAZ Safe Distance For Explosive Ordnance Containing Electro-Explosive Devices From General Use Transmitters of 02 Feb 11. Safe distances are provided for a number of typical exposure scenarios where there is a requirement to have EO in proximity to some common RF transmitters. For situations that are not covered by the provided scenarios, or where the safe distances are operationally overly restrictive, or where the safe distance cannot be complied with, then further assessment must be conducted on a case by case basis in accordance with DEOP 115(AM1) *Defence Electro-Explosive Hazards Manual*. This may require the conduct of RF measurement surveys and EEH trials of specific EO configurations.

15.19 It must be noted that DEOP 115(AM1) *Defence Electro-Explosive Hazards Manual* requires a minimum safe distance of 3m be applied where the calculated safe distance is less than 3m, unless specifically exempted here or by authoritative advice from DOS.

15.20 Where doubt exists as to the safe distances to be applied for a given situation, DOS is to be contacted for authoritative advice.

Transportation

15.21 It is not practicable to achieve a safe EED environment during transportation through the observance of calculated safe distances. For this reason, all EED and systems containing EEDs offered for transportation should be assessed as safe in the ADF Baseline RF Environment for sea and air transportation. It is highly unlikely that the RF environment along road transport routes will exceed that allowable by ARPANSA RPS No3 Maximum Exposure Levels to radiofrequency Fields –

3 kHz to 300 GHz for the General Public, and any EO cleared to the ADF Restricted RF Environment will therefore be safe for transport in this fashion without the need for further protection or screening.

15.22 Service EEDs and systems containing EEDs which have not been cleared to the levels of the ADF Restricted RF Environment and those requiring protection in a more severe RF environment (eg, ship or aircraft transportation) must be protected during transit by enclosure in a metal box or by approved materials providing sufficient screening. Specific instructions for munitions incorporating EEDs which are either cleared or not cleared for transportation depending on RF protection are to be found in EO Item Publication Topic – 027.

15.23 Where munitions are required to be closer than the minimum 3m to vehicle fixed transmitters/antenna authoritative advice should be sought from DOS. Dependent on the power output, frequency and cable routing this may in some cases be reduced to 0.2m for systems assessed as safe in the ADF Baseline RF Environment.

15.24 When it is considered necessary to transport systems containing EEDs of unknown susceptibility, the RF environment must be limited to the ADF RADHAZ to Ordnance Susceptible Environment. All personnel engaged in the carriage of such articles should be aware of RF hazards and observe consignor's instructions fully. Note should be made of any special instructions covering loading/unloading/handling when EEDs are typically most vulnerable to EM radiation.

Unit/Flight Line Safe Distance

15.25 Considering the large mixed inventory of EO stored, maintained, transported and used within the ADF, and their varying susceptibilities, and the numerous facilities at which they can be found, the most effective methodology to determine a generic safe distance for all serviceable ADF EO is to assume that all in-service electrically initiated devices are only safe when subjected to the ADF Susceptible RF Environment. The safe distances in Table 15-1 are based on this assumption.

15.26 For radio systems only, where the transmitter information is known, but the susceptibility of the munition is unknown, the safe distances in Table 15-1 are to be maintained. Where the gain of the antenna is not known then a Gain of 6 dBi is to be assumed (indicated in RED in Table 15-1) for stub, stick or whip type antennas. Table 15-1 is not to be used to determine safe distances from pulsed emitters such as radars.

ANTENNA GAIN RATIO (dBi)	**TRANSMITTER POWER IN WATTS**								
	1 W	**5 W**	**10 W**	**15 W**	**20 W**	**25 W**	**30 W**	**50 W**	**100 W**
UNITY (0)	3.0	6.0	9.0	11.5	13.0	15.0	18.0	20.0	28.0
SPECIAL (2)	4.0	9.0	11.5	15.0	18.0	19.0	20.0	25.0	35.0
STANDARD (3)	4.0	9.0	13.0	18.0	19.0	20.0	25.0	28.0	35.0
HIGH GAIN (5)	6.0	11.5	18.0	20.0	25.0	25.0	25.0	35.0	55.0
HIGH GAIN (6)	6.0	13.0	19.0	25.0	25.0	28.0	35.0	55.0	55.0

Table 15–1: Quick Reference Minimum Separation Distance (metres) for Serviceable ADF EO from Radios Operating between 2 MHz to 1 GHz

15.27 **RADHAZ Unsafe EO.** When EO is transported around facilities in non-standard configurations as defined in paragraph 15.11, the EO is classified as RADHAZ Unsafe and the safe distances at Table 15-2 must be maintained for frequencies up to 300 MHz. Above 300 MHz to 1GHz, the safe distances at Table 15-1 must be maintained. Where the gain of the antenna is not known then a Gain of 6 dBi is to be assumed (indicated in RED in Table 15-2) for stub, stick or whip type antennas. Table 15-2 is not to be used to determine safe distances from pulsed emitters such as radars.

ANTENNA GAIN RATIO (dBi)	TRANSMITTER POWER IN WATTS								
	1 W	5 W	10 W	15 W	20 W	25 W	30 W	50 W	100 W
UNITY (0)	11.5	25.0	36.0	50.0	52.0	57.0	65.0	85.0	115.0
SPECIAL (2)	15.0	36.0	50.0	57.0	65.0	73.0	85.0	100.0	145.0
STANDARD (3)	15.0	36.0	52.0	65.0	73.0	85.0	100.0	115.0	145.0
HIGH GAIN (5)	25.0	50.0	65.0	80.0	100.0	100.0	100.0	145.0	230.0
HIGH GAIN (6)	25.0	52.0	73.0	100.0	100.0	115.0	145.0	230.0	230.0

Table 15–2: Quick Reference Minimum Separation Distance (metres) for RADHAZ Unsafe EO from Radios Operating Below 300 MHz

Demolition Detonators

15.28 The safe distances for an operator laying a demolition circuit is based on the worst case of:

a. an operator holding the detonator wires with the potential to form a 2 metre dipole, and

b. the use of an electrically connected configuration, assuming a 100 m length of black and brown twisted firing cable between the EED and firing box.

15.29 When handling/connecting the detonator the distances in Table 15-2 must be maintained for transmitters whose frequencies are 300 MHz and below. Above 300 MHz to 1 GHz, the safe distances in Table 15-1 must be maintained.

15.30 Once connected to 100 m of laid black and brown cable the firing circuit will remain safe from all transmitters up to 100 Watts at a distance of 10 m. For larger lengths, or for unmoulded twin electrical cable where the separation between the two wires is uncontrolled (i.e. NOT figure 8 cable or twisted pair), or charges initiated by a loop circuit, authoritative advice should be sought from DOS.

15.31 Demolition firing cable D10 was originally procured for telephone cable and is a black sheathed, loose bound pair of steel wires. Though it should not be encouraged it is in common use for routine demolition work by all 3 Services as there is an abundant stock available. When D10 is used all radios should maintain a distance greater than the 6 dBi distances in Table 15-2, unless specific authoritative advice has been provided by DOS.

Managing Transmitters Inside Explosive Ordnance Areas

15.32 **Transmitters outside the Explosive Ordnance Area perimeter.** Transmitters outside an EO Area can radiate into an EO Area and therefore control of these transmitters is necessary. Radios of 50 watts or less, with an antenna gain of 6dBi or less, may be safely operated outside the EO Area and at least 100m from a process building. For higher power radios, radars or where shorter distances are required, authoritative advice from DOS is to be sought.

15.33 A RADHAZ Map is to be maintained by EO facility managers that shows the locations of all transmitters and licensed areas on Base, and is to list any restrictions that are necessary for the transport, handling and storage of electrically initiated EO.

15.34 Transmitters inside Explosive Ordnance Area. In the past there has been a blanket ban on the use of transmitters within an EO Area. But now there are a number of portable radios (both hand-held and manpack) in service or being used by contractors/site personnel during maintenance and movement periods and it is likely that they will become more widely used. The use of remote equipment such as lawn mowers, cable or pipe locators, management radios, data links and RFID tags, Wi-Fi, automatic gate opening transmitters etc. is also becoming more common. With the increase in use of mobile transmitters this blanket ban is becoming much more difficult to uphold in order to maintain efficient and safe working practice. Therefore the owner/managers of a facility must assess all RF transmitters to be used within the EO Area for their potential RADHAZ. The paragraphs below set out the rules for transmitters inside EO Areas and licensed EO buildings.

15.35 The safe distances apply equally to the use of transmitters in vehicles transporting EED in EO Areas.

15.36 Where a hazardous atmosphere, or an explosive hazardous atmosphere exists, only transmitters that meet the requirements for the applicable Zone may be used. These requirements are at Regulation 6.3, Procedure 1.

15.37 Approval of transmitters inside Explosive Ordnance Areas. The use of transmitters inside EO Areas may be approved by EO facility managers provided the requirements of this chapter are met. In approving the use of transmitters in EO Areas, EO facility managers are required to:

a. Assess whether the use of the transmitter is essential for the activities conducted in that facility,

b. Ensure the transmitter meets the requirements of this chapter for the area it is to be used in,

c. Provide any approval of the use of transmitter, by make and model, in writing, and

d. Maintain a register of all approved transmitters.

15.38 Inside Explosive Ordnance Area External to Licensed EO Buildings. No deliberate RF transmitters of any power are to be allowed inside an EO Area unless they are essential for an activity that is taking place there. Portable radios, personnel communication equipment, mobile phones, Personal Electronic Devices (PED), and data communications transmitters may be used inside an EO Area and external to licensed buildings subject to the following (summarised at Table 15-3):

a. For all transmitters with a power output of ≤ 20 W, an antenna gain of ≤ 6 dBi, at a frequency of > 1000 MHz are safe at a distance of ≥ 5m from the exterior of the buildings.

b. For all transmitters with a power output of ≤ 10 W, with an antenna gain of ≤ 6 dBi, at a frequency of > 300 MHz are safe at a distance of ≥ 10 m from the exterior of the buildings.

c. All transmitters with a power output of ≤ 1 W, with an antenna gain of ≤ 6 dBi, across the frequency spectrum are safe at a distance of ≥ 10m from the exterior of the buildings.

d. All transmitters with a power output of ≤ 5 W, with an antenna gain of ≤ 3 dBi, across the frequency spectrum are safe at a distance of ≥ 10m from the exterior of the buildings.

e. Within an EO Area and external to buildings where EO containing EED are stored in their approved packaging (i.e., ordnance not unpacked, handled or worked on) transmitters with a power output of ≤ 25 W, with an antenna gain of ≤ 6 dBi, across the frequency spectrum are safe at a distance of 3m from the exterior of the buildings. Due to the possible problems with ensuring that all items remain packed at all times the use of radios at this power level shall only be permitted where absolutely essential and where strong controls are in place and can be assured to be in place for the lifetime of the transmitter. Where there is doubt the safety distances and power levels of paragraph 15.38 a to d above shall be applied.

f. During deployment where ordnance is stored on open ground sites but are housed within their approved packaging (i.e. ordnance not unpacked, handled or worked on) transmitters with a power output of ≤ 25 W, with an antenna gain of ≤ 6 dBi, across the frequency spectrum are safe at a distance of 3m from the nearest packed item.

g. **Anti-Theft Tracking Devices.** Some vehicles, especially 'white van fleet' are now fitted with anti-theft tracking devices/stolen vehicle recovery systems, such as Tracker, Trackback, and Demonscan, often without the driver's knowledge, and as such it must be assumed that all vehicles entering an EO Area have them fitted. The typical tracking system has a maximum power output of 2 Watts. A safe distance of 5 m between the vehicle and the exterior walls of any building containing explosives must be maintained. All EO at a minimum, during transportation and storage, should be safe in the ADF Restricted RF Environment and as such will not be at hazard from the radiated power from the anti-theft tracking device.

Power Output (W)	**Gain (dBi)**	**Frequency (MHz)**	**Safe Distance (m)**
≤ 20	≤ 6	≥ 1000	≥ 5
≤ 10	≤ 6	≥ 300	≥ 10
≤ 1	≤ 6	All Frequencies	≥ 10
≤ 5	≤ 3	All Frequencies	≥ 10
EO containing EED stored in their Approved Packaging			
≤ 25	≤ 6	All Frequencies	≥ 3

Table 15–3: Safe Distance (metres) inside Explosive Ordnance Area - External to Licensed EO Building

NOTES

Transmitter power is to be taken as the maximum the set is capable of emitting – not a level which may be operator or software controlled.

The above safe distances shall also be maintained between the transmitter and EO Area transit routes.

By convention and for ease of measurement and estimation, distances are rounded up to 3, 5 or 10 m.

15.39 For all other transmitters outside these parameters authoritative advice should be sought from DOS.

15.40 Information relating to transmitter parameters is generally available in the equipment handbooks, manufacturer product specifications or from appropriate specialist agencies (eg, GTESPO or Electronic Systems Division, DMO).

15.41 **Inside EO Building - Outside of Process Room.** No deliberate RF transmitters of any power are to be allowed inside an EO Building unless they are essential for an activity that is taking place there, and which meet the following requirements:

a. **Process Building.** Transmitters with an Effective Isotropic Radiated Power (EIRP) less than 5 W are permitted inside EO process buildings. A minimum safe distance of 3m must be maintained between the transmitters and electrically initiated devices, and

b. **Explosive Ordnance Store House.** Transmitters with an EIRP less than 10 W are permitted inside EO store houses. A minimum safe distance of 3m must be maintained between the transmitters and electrically initiated devices.

15.42 **Inside Explosive Process Room.** No transmitters with an EIRP in excess of 1W shall be permitted inside an EO process room (unless using a transmitter is part of the documented approved maintenance process). A minimum safe distance of 3m must be maintained between the transmitters and electrically initiated devices.

15.43 **Mobile Phones, Pagers and Associated Communication Devices.** Use of mobile phones and pagers must be controlled in the vicinity of EO. As their power output is unpredictable and can be well in excess of 1W, mobile phones, pagers and associated communication devices may NOT be used:

a. in Explosive Ordnance Storehouses (EOSH);

b. at Potential Explosion Sites (PES);

c. in magazines;

d. in munition stowage areas;

e. in explosive process buildings;

f. close to ordnance under preparation; and

g. where a hazardous atmosphere, or explosive hazardous atmosphere exists.

15.44 Subject to the above, mobile phones and pagers may be used in other areas provided that:

a. only standard handheld phones/pagers are used. (That is mobile phones or pagers without any external devices used to improve signal strength such as amplifiers, additional high gain antennas, network extenders, cell phone boosters or cellular repeaters.) and

b. a minimum separation distances of 3m is maintained.

15.45 **Personal Role Radio.** The Personal Role Radio (PRR) has been assessed as being safe for use by personnel handling in-service explosive items. No further control is therefore required for them except in process areas where the rules of paragraph 15.42 should be applied.

Exemptions to 3m Rule

15.46 With the introduction of low power transmitters in logistic systems and office information systems, there are compelling reasons based on improving productivity and efficiency for the use of these systems closer than 3 metres to ordnance or for use in storage, assembly, and munition build- up areas. Examples of these sorts of devices are Automatic Identification Technology (AIT) devices, wireless laptops, passive Radio-Frequency Identification (RFID) and active RFID. These devices are generally very low output devices (i.e., less than 1 watt) and their proximity to ordnance and low output power require different techniques for mitigating electro-explosive hazards. The ensuing paragraphs provide exceptions to the minimum safe separation distance of 3 m, as well as general guidance for the use of these types of devices in and around ordnance locations and aircraft.

15.47 Table 15-4 provides exceptions to the minimum safe separation distance requirement of 3 metres and is particularly useful for handheld devices radiating at less than 1 watt.

<table>
<tr><th rowspan="2">Minimum Separation Distance (m)</th><th colspan="2">EO RADHAZ Clearance</th></tr>
<tr><th>RADHAZ Safe in the ADF Baseline or Restricted RF Environment</th><th>RADHAZ Susceptible below the ADF Restricted RF Environment</th></tr>
<tr><td>1.5</td><td>0.5 < EIRP ≤ 5 watts
All Frequencies</td><td>EIRP ≤ 0.5 watts
Frequencies ≥ 100 MHz</td></tr>
<tr><td>0.3</td><td>0.1 < EIRP ≤ 0.5 watts
All Frequencies</td><td>0.025 < EIRP ≤ 0.1 watts
Frequencies ≥ 200 MHz</td></tr>
<tr><td>0</td><td>EIRP ≤ 0.1 watts
All Frequencies</td><td>EIRP ≤ 0.025 watts
All Frequencies</td></tr>
<tr><td colspan="3">EIRP = Pt x Gt

Where:
EIRP is the effective isotropic radiated power in watts.
Pt = average power output of the transmitter in watts.
Gt = numerical (far field) gain ratio (not the dB value) of the transmitting antenna, derived as follows:
Gt = 1 x 10 G/10 where
G = gain in dBi

Example: If the antenna far field gain is 2.15 dBi, the far-field gain ratio is

$1 \times 10^{2.15/10} = 1 \times 10^{0.215} = 1.64$</td></tr>
</table>

Table 15–4: Exceptions to the 3m Minimum Safe Separation Distance

15.48 Wi-Fi and Bluetooth. With the emergence of wireless networks many mobile computers come standard with built in Wi-Fi (short for “Wireless Fidelity”) radios, as defined by IEEE Std 802.11. Wi-Fi can be used to provide high-speed connections (11 Mbps or greater) to mobile computers, desktop computers, Personal Digital Assistants (PDAs). There are several Wi-Fi standards that use different transmission channels. The four commonly used in general commercial equipments offer different modes of operation, which lets them reach different data transfer speeds depending on their range as follows:

a. **WiFi 802.11a.** The 802.11a standard (called WiFi 5) allows higher bandwidth (54 Mbps maximum throughput, 30 Mbps in practice). The 802.11a standard provides 8 radio channels in the 5.8 GHz frequency band. The 802.11a standard relies on a technology called Orthogonal Frequency Division Multiplexing (OFDM)). Dependent of the baud rate the RF transmit power can be as high as 29dBm. Devices that are confirmed to be using 802.11a transmitters are considered safe at a distance of 1m from all serviceable ADF EO.

b. **WiFi 802.11b.** The 802.11b standard is currently the most widely used one. It offers a maximum throughput of 11 Mbps (6 Mbps in practice) and a reach of up to 300 metres in an open environment. It uses the 2.4 GHz frequency range, with 3 radio channels available and Direct Sequence Spread Spectrum (DSSS) technology. In Australia the RF transmit power is typically 23 dBm in 802.11b mode for 1 - 11 Mbps. Devices that are confirmed to be using 802.11b transmitters are considered safe at a distance of 0.3m from all serviceable ADF EO.

c. **WiFi 802.11g.** The 802.11g standard offers high bandwidth (54 Mbps maximum throughput, 30 Mbps in practice) on the 2.4 GHz frequency range, with OFDM coding. In North America and Australia the RF transmit power is typically 20 dBm in 802.11g mode for 6 - 54 Mbps. Devices that are confirmed to be using 802.11g transmitters are considered safe at a distance of 0.3m from all serviceable ADF EO.

d. **WiFi 802.11n.** Devices incorporating the improved 802.11n standard, by adding multiple-input multiple-output antennas (MIMO), are becoming increasingly common.

802.11n devices operate on both the 2.4GHz and 5GHz bands and typically have a combined RF transmit power of 20 dBm. Devices that are confirmed to be using 802.11n transmitters are considered safe at a distance of 0.3m from all serviceable ADF EO.

15.49 The above safe distances assume an antenna gain of 6dBi or less. For WiFi devices with higher antenna gains, authoritative advice from DOS is to be sought.

15.50 **Bluetooth.** Bluetooth uses a radio technology called frequency-hopping spread spectrum, which ‘chops up’ the data being sent and transmits chunks of it on up to 79 bands (1 MHz each) in the globally unlicensed Industrial, Scientific and Medical (ISM) range 2402-2480 MHz. Bluetooth systems are designed and constructed to meet the requirements of the Bluetooth specification. There are three classes of operation dependent on range:

a. Class 1, operating at 100mW for 100m range,

b. Class 2, operating at 2.5mW for 10m range, and

c. Class 3, operating at 1mW for 1m range.

15.51 There are no restrictions to Bluetooth operating at Class 2 or 3. Class 1 Bluetooth transmitters should maintain a distance of 0.3 m from EO considered safe in the ADF Baseline RF Environment and the ADF Restricted RF Environment.

15.52 **Data Loggers.** To assist with in-service monitoring of the natural and induced environments that EO is exposed to throughout its life cycle there maybe a requirement for the use of data loggers in close proximity to electrically initiated devices. Data Loggers installed within munition storage containers with transmitters operating shall have an EIRP less than 50 mW and shall operate at a frequency greater than 2000 MHz.

Devices Requiring Separate Advice

15.53 **Radio Frequency Identification.** RFID is a technology that uses communication via electromagnetic waves to exchange data between a terminal and an object e.g. ammunition containers. There are three types of RFID tags:

a. Passive RFID tags, which have no power source and require an external electromagnetic field to initiate a signal transmission.

b. Active RFID tags, which contain a battery and can transmit signals once an external source interrogator has been successfully identified.

c. Battery assisted passive (BAP) RFID tags, which require an external source to wake up but have significantly higher forward link capability providing greater range.

15.54 As both frequency and power output can vary significantly from system to system, generic safe distances from explosive stores containing EED cannot be provided. Before any system is introduced, authoritative advice must be sought from DOS.

15.55 **IEEE 1902.1 Standard Devices (RuBee).** Another technology used for automatic identification and tracking is the wireless asset tracking system utilising the IEEE 1902.1 long wavelength wireless network protocol (also known as RuBee). Unlike the RFID technology discussed above, IEEE 1902.1 operates in the long wave magnetic field spectrum, below 450kHz. Due to the low magnetic field radiated, and the mismatch in receive antenna length of the EO compared to the frequency of radiation, there is not perceived to be an EEH from this type of device to electrically initiated devices, but tests are still on going. IEEE 1902.1 devices are not to be used on EO items, in EO packages or in explosive facilities without authoritative advice from DOS.

Transportation Emergency Procedures

15.56 In the event of an incident/accident during transportation of munitions, items which do not normally present a high RADHAZ risk may become acutely vulnerable if there is damage to their inherent protection i.e. structural or packaging, and which become RADHAZ Unsafe. Pending a detailed inspection the following restrictions on RF transmissions in the immediate vicinity should be imposed immediately:

a. No RF transmission is to be allowed within a radius of 10 metres from the explosives load.

b. Emergency services using radios with an EIRP greater than 15 watts should not transmit within 50 metres of the damaged equipment.

c. All non-essential transmitters should be either switched off or removed to a distance greater than 50 m.

REGULATION 4.5 - FACILITY MAINTENANCE

General Overview

5.1 Explosive Ordnance (EO) Facilities are purpose designed structures that contribute to the protection of personnel and surrounding assets in the event of an emergency incident occurring (eg grass fires). For the facility to function as designed, they must be maintained in a serviceable condition. This concept extends to include the surround grounds (eg traverses, buffer zones etc) and vegetation.

Requirements

5.2 EO facilities and areas are to be kept in a serviceable condition so that the risks of an unscheduled EO event occurring, and the consequences of such an event, are kept to a minimum.

Control of Vegetation

5.3 **Vegetation.** Vegetation is to be controlled so as not to present a fire hazard. Grass is to be kept short. Trees and shrubs are to be trimmed of excessive foliage. Removed foliage and excessive grass clippings are to be removed.

5.4 **Fire Breaks.** Fire breaks may need to be installed to inhibit the spread of fire.

5.5 **Herbicides.** Herbicides **must not be used** to kill grass cover on earth traverses and earth covered buildings such as igloos.

5.6 Certain herbicides may be used in EO areas to kill or control weed and grass growth.

5.7 **Use of Fire.** Fire may be used as means of hazard reduction with approval and under special conditions.

Control of Livestock

5.8 **Use of Livestock.** Livestock may be used to control vegetation under certain conditions, should it be determined that livestock is the most appropriate method of controlling vegetation. Electric fences may be used to protect open stacks of EO from grazing animals.

Control of Vermin

5.9 Any animal or bird likely to cause damage to buildings, traverses or installations in EO facilities is considered vermin. Active measures are to be undertaken to eradicate, as far as possible, all such vermin from EO areas and facilities.

5.10 **Pesticides.** The use of pesticides and insecticides is to be carefully controlled to ensure that no deleterious effects will occur to stored EO and that all occupational health and safety requirements are met.

5.11 **Shooting.** Firearms may only be introduced into EO areas under strict control for specific purposes. Shooting for vermin control is permitted if written authorisation is given by the Officer-In-Charge (OIC) of the establishment.

Work Services

5.12 Work services for construction, maintenance, or repair activities are permitted in EO areas and facilities. Written approval from the OIC of the establishment is to be obtained prior to work commencing.

5.13 **Precautionary measures.** Consideration is to be given to the desirability and practicability of removing EO from an area before work commences.

5.14 For security and safety reasons, an officer is to be detailed to maintain close liaison with, or directly supervise contractor's staff, throughout the progression of the work. All the relevant safety instructions, either in this manual or in local instructions, are to be observed. Local instructions for contractors are to be prepared setting out the conditions of entry and general safety precautions in relation to EO.

5.15 **Repair and Maintenance of EO Facilities.** The repair and maintenance of EO facilities is to be undertaken under the following conditions:

a. **Zones 0E, 1E, 2E, or Zone 20E facilities.** No repairs or maintenance of any kind to the structure or equipment are to be carried out while EO is in the building.

b. **Zones 21E, 22E and Zone REA facilities.** Minor repairs and maintenance are permitted without removing EO, provided adequate protection against possible damage to EO can be achieved by the facility supervisor.

c. **Items requiring repair.** Items that require repair must be cleaned and inspected to ensure that no explosive contamination is present prior to work commencing.

d. **Hot Work.** All work that requires the use of heat generating equipment requires a 'Hot Work Permit' authorised by the OIC of the establishment.

e. **Fire Fighting Appliances.** Adequate fire fighting appliances are to be readily available when work is being conducted that requires a 'Hot Work Permit'.

f. **Fire Detection Systems.** Fire detection systems may require to be deactivated when conduct work that requires a 'Hot Work Permit'.

5.16 **Vacation of EO Facilities for periods exceeding Four Months.** When a facility is removed from service for a period likely to be greater than four months the OIC is to request the Licensing Authority to withdraw the Explosive Limit Licence.

5.17 **Mechanical Appliances and Tools.** The use of mechanical appliances and tools, including any associated consumables (such as fuels, oils, etc) are permitted however the conditions of use must be addressed within the local instructions.

5.18 **Repairs to Roads.** Roads into, and servicing EO areas and facilities are to be kept in good condition.

5.19 **Maintenance of Machinery and Plant.** The maintenance of machinery and plant is to be undertaken by the appropriate authority in accordance with standard maintenance routines.

5.20 **Standards of Maintenance.** All work in EO areas and facilities is to be under the supervision of, or undertaken by, appropriately qualified personnel. When electrical work is undertaken a certification is to be obtained from the electrician that the work conforms to the electrical standard of the facility.

Responsibilities

5.21 Each element of Defence, including contractors, whose role involves use of an EO facility or area are responsible for the maintenance and upkeep of the facility.

Procedures

5.22 Procedures are used to implement the requirements of this regulation are:

a. Procedure 1 – Control of Vegetation, Livestock and Indigenous Fauna and Vermin

b. Procedure 2 – Work Services within Explosive Ordnance Areas and Facilities

PROCEDURE 1 - CONTROL OF VEGETATION, LIVESTOCK AND INDIGENOUS FAUNA AND VERMIN

Introduction

1.1 In the interest of protecting explosive ordnance buildings and open stacks of Explosive Ordnance (EO) from fire, the growth of natural vegetation within the EO area must be controlled. In order to prevent damage to facilities and traverses within such areas, the grazing of introduced livestock, and indigenous fauna and vermin may also need to be controlled. In effecting such control due cognisance must be given to all applicable environmental legislation.

Purpose

1.2 This procedure details minimum requirements for the control of vegetation, livestock and vermin in designated EO areas.

Applicability

1.3 Since fire and environmental protection requirements vary considerably throughout Australia, more or less stringent requirements than those detailed in this instruction may be required to provide adequate fire safety and other controls whilst complying with environmental laws. Also, special circumstances, eg historical and significant forest area, wetlands, etc, may affect compliance with these instructions. Accordingly, Officers-in-Charge (OIC) of establishments must consult with Regional Fire Safety Officers (RFSO) and Regional Environmental and Sustainability Officers (RESO) in the Estate and Infrastructure Group (E&IG)), and local authorities, as appropriate, in implementing these instructions. OIC may therefore authorise lesser conditions provided the variations are considered adequate by RFSO/RESO. Conversely, where the RFSO/RESO considers the stipulated requirements are inadequate, the OIC is required to achieve the minimum requirements stipulated by the RFSO/RESO. In either case, the OIC is to ensure that the requirements together with justification for them are detailed in writing by the RFSO/RESO concerned.

1.4 Generally, the requirements of this instruction should also be applied to buildings and lock-ups licensed to hold small quantities of EO (Small Quantity Facilities) for ready-use purposes and not located in designated EO areas. Specific requirements for Small Quantity Facilities are detailed in Regulation 5.3 Procedure 1

CONTROL OF NATURAL VEGETATION

General

1.5 **General Requirements.** General requirements for the control of vegetation surrounding EO buildings and open stacks of EO are detailed in paragraphs 1.9 to 1.12 inclusive.

1.6 **Specific Requirements.** The extent of natural vegetation control in the vicinity of EO facilities depends largely on whether or not the facilities are of fire-resistant construction and are traversed or untraversed. Vegetation control measures vary accordingly and are detailed in paragraphs 1.13 to 1.16 inclusive.

1.7 **Concealment of EO Buildings.** Where concealment of EO buildings and stacks from airborne observers is a requirement, specialist advice is to be sought on how this can be achieved whilst still maintaining an appropriate level of fire protection.

1.8 **Methods for Control of Vegetation.** The methods used to control vegetation will depend on the type of vegetation and the terrain. Cutting or slashing is suitable for cultivated or reasonably level natural grassed areas. Herbicides may be used in accordance with paragraphs 1.17 to 1.20. Where the terrain or trees prevent easy access for cutting or slashing, the clearing of undergrowth and other obstacles to grass cutting is not intended and vegetation should be left in its natural state. In these circumstances fire may be used to reduce the undergrowth in accordance with paragraphs 1.21 and 1.22.

General Requirements

1.9 Control of Vegetation in General Area. Vegetation in EO areas is to be controlled so as not to present a fire hazard. Normally, the height of the grass in this area is to be maintained at not more than 200 mm (see Note). When it is impracticable to deal with the whole area at once, the grass in the general area away from EO buildings and stacks, ie beyond 15 to 20 m radius, may be permitted to grow to a maximum height of 350 mm, provided that the height is reduced to below 200 mm as soon as possible

NOTE

Throughout this instruction the height of the grass is the height to the top of the grass leaves in natural repose measured from the ground. The height does not include the length of the flower or seed stems.

1.10 Priority for Grass Cutting. In reducing the height of grass to below 200 mm, first priority is to be given to the area 15 to 20 m around all EO buildings and stacks, and the general area is to be cut only after all buildings and stacks have been attended to in this regard.

1.11 Cut Vegetation. Cut tree and shrub foliage and excessive cut grass is to be removed on the day of cutting from the area within 20 m of any building or stack of EO. Cut tree and shrub foliage anywhere else within the EO area is to be removed within three days of cutting.

1.12 Fire Breaks. Firebreaks may need to be installed to inhibit the spread of fire and to provide a safe point from which to conduct firefighting operations (back-burning if conditions permit). In addition to the firebreak (no growth of any kind) requirements of paragraphs 1.14 to 1.16, a firebreak at least 15 m wide may be required on the inside and adjacent to the EO area perimeter fence. This width may require considerable widening depending on local conditions. If necessary, additional internal fire breaks may be installed to a width of approximately 7 m. Access tracks and sealed roads may be utilised to augment the installed firebreak system. Soil degradation effects should be carefully considered before ploughing or rotary hoeing is proposed for use in forming firebreaks. The above notwithstanding, no firebreaks may be installed without the concurrence of the RESO.

Specific Requirements

1.13 Fire-Resistant Buildings - Untraversed. In the vicinity of EO buildings that are of fire-resistant construction, ie Type 2 – heavy walled construction with protective roof, Type 3 – earth- covered building and Type 4 – igloo construction, the growth of natural vegetation within 15 to 20 m of the building is to be controlled as follows:

a. Suitable native evergreen plants that have a mature height not exceeding 300 mm should, if possible, be grown in the 15 to 20 m wide area around the building. Ground ivy is a suitable evergreen plant in temperate climates as it is easily confined, and does not grow high. In other climates, fire retardant ground covers that are non- invasive (obtain advice from the RESO) should be grown. Generally, growing of evergreen plants in the vicinity of the buildings, and on the earth covering of Type 3 and Type 4 buildings is preferable since they reduce the fire hazard and require less maintenance, such as mowing, than do ordinary grasses.

b. Where natural grass is grown in the 15 to 20 m wide area, and where circumstances permit, eg small number of buildings, adequate funds, facilities and manpower, the height of the grass is to be maintained at less than 200 mm. Where the number of buildings within the EO area is such that maintaining the height of grass at less than 200 mm is assessed by the local service or civilian fire authority as impracticable, the grass in this 15 to 20 m wide area may be permitted to grow to a maximum height of 350 mm, provided that the height is reduced to below 200 mm as soon as possible.

c. Trees and shrubs or their foliage are not permitted within a 15 to 20 m wide area around the building.

1.14 Fire-Resistant Buildings - Traversed. Where fire-resistant buildings are surrounded by a solid-wall or earth traverse, the requirements of paragraph 1.13 apply, except as follows:

a. The area between the walls of the building and the foot of a solid-wall traverse is preferably to be kept free of any growth, or natural grass is to be kept to a height less than 100 mm. In the case of earth traverses, the growth-free area is not to be permitted to encroach on the foot of the traverse in order to ensure the foot of the traverse is not eroded. Concrete or bitumen paths around the building are suitable as a means of meeting this growth free requirement; alternatively, the area may be treated with herbicides (see paragraphs 1.17 to 1.20) or rotary-hoed or ploughed. However, soil degradation effects should be carefully considered before ploughing or rotary hoeing is used to form the clear area.

b. Every reasonable effort should be made to establish native evergreen plants (not exceeding 300mm mature height) on earth traverses otherwise the height of natural grass must never be permitted to exceed 200 mm.

1.15 Non-Fire-Resistant Buildings and Explosive Ordnance Stacks – Untraversed. The requirements for the control of vegetation surrounding untraversed non-fire-resistant buildings and open stacks of EO are the same as those stated in paragraph 1.13 for untraversed fire-resistant buildings except as follows:

a. **Explosive Ordnance Buildings.** For buildings with walls of brick, concrete or any other non-combustible materials such as metal cladding, growth of natural grass within 2 m of the walls is not to exceed 100 mm.

b. **Stacks of Explosive Ordnance.** The height of natural grass within an area of 15 to 20 m of the stack is not to exceed 100 mm.

1.16 Non-Fire-Resistant Buildings and Explosive Ordnance Stacks – Traversed. The requirements for the control of vegetation surrounding traversed non-fire-resistant buildings and open explosive ordnance stacks of EO are the same as those stated in paragraph 1.14 for traversed fire-resistant buildings except as follows:

a. The height of the natural grass on earth traverses is not at any time permitted to exceed 200 mm.

b. For stacks of EO the height of natural grass within 30 m of the stack (and includes the traverse) must never exceed 200 mm.

Use of Herbicides

1.17 Herbicides **MUST NOT BE USED** to kill grass cover on earth traverses and earth covered buildings such as igloos. Destruction of the grass may quickly lead to the erosion and/or subsidence of the earth cover thereby diminishing or destroying the explosive and protective characteristics of the building/traverse combination, or the traverse ie for a traverse, the ability to effectively trap incoming or outgoing fragments. If the grass cover is totally destroyed other forms of protection for the earth cover from the weather, must be applied.

1.18 Herbicides may be used in EO areas to kill or control weed and grass growth, provided that for each herbicide:

a. The manufacturers Material Safety Data Sheet indicates the product is non-flammable and noncorrosive;

b. The manufacturers directions and safety precautions are followed and all other occupational health and safety requirements are met;

c. The product is authorised for use by the appropriate Departmental authority (eg Defence Safety Management Agency); and

d. Approval for use of herbicides in the locality is given by the RESO or the use of herbicides for the purpose is authorised in the local Environmental Management Plan.

1.19 To ensure that herbicides and EO do not come into contact with one another and thereby cause a possible compatibility problem, the application of herbicides is to comply strictly with the following:

a. **Herbicides Applied by Spraying.** Herbicides may be sprayed anywhere in EO areas except:

(1) Within 5 m of a closed EO Storehouse (EOSH) and a closed and empty EO Workshop (EOW),

(2) Within 50 m of an EOW which contains EO or an open EOSH,

(3) Within 50 m of a loading/unloading operation (eg at a wharf, EOSH, EOW etc),

(4) Within 50 m of packaged EO exposed to the weather (eg EO on a wharf awaiting loading), and

(5) In windy conditions.

b. **Herbicides Applied by a Wand (eg Zero Weeding Wand).** Herbicides may be applied by means of a wand anywhere in EO areas.

c. **Herbicides Applied in Granular Form (eg Ciba-Geigy Erase).** Granular herbicides may be used anywhere in EO areas provided granules are not left exposed on walkways or roads.

1.20 After the application of herbicides dead foliage is to be removed so as not to become a fire hazard.

Use of Fire

1.21 Fire may be used as a means of hazard reduction under the following conditions:

a. Unless the use of fire for the purpose is authorised in the local Environmental Management Plan, burning is only to take place after approval is given by the OIC of the establishment in consultation with the RESO and the local fire or bushfire authority, who may be invited to assist with the operation.

b. The requirements of Regulation 4.4 Procedure 1 relating to the control of the means of ignition are followed.

c. Burning is only to take place in suitable weather conditions, allowing easy control of the fire.

d. Burning is NOT to take place when fire bans are in force.

e. Burning is NOT to take place within 30 m of any EO storage facility or within 200 m of any open EO storage area.

f. Burning should normally take place in autumn or spring. Autumn is preferred as the vegetation will be dry after the summer and there is less likelihood of the fire flaring up again after apparently being extinguished.

g. During burning operations, all doors, windows and ventilators of EO storage facilities and workshops are closed. No work is to be carried out in EO workshops.

h. Fires are to be extinguished before nightfall, but arrangements are to be made to patrol the burned area until all likelihood of a flare up has passed.

i. Fallen dead timber should preferably be removed rather than burned as it can smoulder for a considerable time after the main fire has been extinguished.

1.22 It is advisable to maintain liaison with the local fire or bushfire authority and adjacent landowners or tenants to obtain advice of any hazard reduction burns that may be planned for areas surrounding the EO area.

CONTROL OF LIVESTOCK

General

1.23 The recent trend has been away from grazing livestock in EO areas due to the inherent problems, however if grazing is determined to be the most appropriate method of vegetation control, the following conditions are to be met:

a. Correct authorisation (including issue of leases) for grazing on such areas is obtained through the appropriate agency.

b. EO in open stacks, except bombs and projectiles, is protected by fencing of a type suitable to exclude the livestock.

c. Earth traverses are not damaged.

1.24 Electric wire fences may be used to protect open stacks of EO from grazing animals. However, these fences, and the equipment used to electrify them, are to be of a type approved by the Directorate of Explosive Ordnance Services and are only to be operated by a 6 or 12 volt battery. Under no circumstances are they to be connected to a mains supply of electricity. Such fences are not to be sited within 5 m of any stack of EO and are to be turned off during handling and loading of items in the stack.

Livestock in Transit

1.25 Provided approval has been given by the OIC of the establishment, livestock in transit is permitted to pass through an EO area.

CONTROL OF VERMIN

General

1.26 Any animal or bird likely to cause damage to buildings, traverses or installations in EO facilities is considered vermin. For example, rabbits may damage traverses and buildings, small rodents may damage packaging or electrical insulation and burrowing insects such as termites will damage any wooden packages or structures. Active measures are therefore to be taken to eradicate, as far as possible, all such vermin from EO areas and facilities.

1.27 The use of pesticides and insecticides is to be carefully controlled to ensure that no deleterious effects will occur to stored EO and that all occupational health and safety requirements are met. In general, the requirements given in paragraph 1.18 for the use of herbicides are to be applied to the use of pesticides and insecticides. It may be necessary to move stock to other locations while pesticides and insecticides are being applied. Workshop operations may have to be suspended temporarily if no alternative workshop is available.

Shooting

1.28 Firearms mayonly be introduced into EO areas under strict control for specific purposes (see Regulation 4.4 Procedure 1). Shooting for vermin control is permitted if written authorisation is given by the OIC of the establishment. This authorisation is to include the conditions under which shooting is to take place and specify:

a. The names of those authorised to shoot;

b. The name of the person responsible for supervising the operation;

c. The date(s) and time(s), normally, only in daylight outside working hours on days when fire bans are not in force;

d. The area(s) and direction(s) of fire to which shooting is to be limited;

e. The number and type(s) of firearms and ammunition to be used;

f. Any other restrictions considered appropriate.

PROCEDURE 2 - WORK SERVICES WITHIN EXPLOSIVE ORDNANCE AREAS AND FACILITIES

Introduction

2.1 Good storage facilities for explosive ordnance (EO) are essential to preserve these valuable assets as well as ensuring that overall safety is not compromised. It is just as important to ensure that these facilities are maintained in good order and that any maintenance required is carried out in a safe and timely manner.

Purpose

2.2 The purpose of this procedure is to prescribe the requirements to be observed in relation to work services permitted in EO areas and in individual EO facilities.

GENERAL

2.3 Works Services for construction, maintenance, or repair activities are permitted in EO areas and facilities only with the written approval of the Officer-in-Charge (OIC) of the establishment, or his/her delegated representative, who is to be informed of the nature of the work to be done, the methods to be employed and the type of plant to be used, in order that he/she may decide on the potential risk before the work begins. When the EO area is not clearly defined and work services are required for the EO area or facilities, the OIC of the establishment, or his/her delegated representative, is to give precise details of the restricted areas to contractor's staff responsible for such work services.

NOTES

Where the term 'Officer-in-Charge' appears in this instruction it may be read to mean 'Officer-in-Charge or his delegated representative' unless otherwise specified.

In general, work on Army unit storage facilities is only to be authorised by an Ammunition Technical Officer or Warrant Officer Ammunition Technician.

Precautionary measures

2.4 Consideration is always to be given to the desirability and practicability of removing the EO from an area or building before work is commenced in the vicinity.

2.5 For security and safety reasons, an officer is to be detailed to maintain close liaison with, or directly supervise contractor's staff, as appropriate, throughout the progress of the work. This officer is to ensure that the necessary precautions are taken to protect the EO from damage or risks and that the work is done in accordance with the agreed method.

2.6 All the relevant safety instructions, either in this publication or in local instructions, are to be observed.

2.7 Local instructions for contractors are to be prepared setting out the conditions of entry and general safety precautions in relation to EO. For convenience these instructions can be incorporated into instructions covering security aspects as required by the electronic Defence Security Manual (eDSM). The unconditional acceptance of these instructions is to be a condition of the work contract. These instructions should address, but not necessarily be limited to the following:

a. Conditions of entry and control of access to establishment, EO area and facilities;

b. Private and LPG fuelled vehicles;

c. Searches;

d. Cameras;

e. Prohibited articles;

f. Permitted articles;

g. Permits required;

h. Use of mechanical tools and appliances;

i. Storage of materials;

j. Fire extinguishers;

k. Mobile radio transmitters (including those fitted to vehicles);

l. Mobile phones and pagers;

m. Occupational health and safety legislation and local instructions;

n. Control of asbestos; and

o. Securing of work site at close of business.

FACILITY CONSTRUCTION SITES

Safety distances to be applied to facility construction sites

2.8 The overarching explosive safety principle of exposing the minimum number of personnel to the minimum quantity of explosives for the minimum amount of time is applicable, as is the principle of sharing information in relation to risk and liaising closely where contractors are involved. In addition, the requirement for the Work Health and Safety legislation to reducing risks so far as reasonably practicable needs to be met.

2.9 The inhabited building distance (IBD) represents a level of risk to construction workers equivalent to the level of risk presented to sites permanently occupied by the general public from a potential explosion site (PES). Construction work on EO facilities is to be undertaken with a minimum distance from the surrounding PES of the IBD; the NEQ in the PES is to be reduced if required to achieve IBD. The requirements of paragraphs 2.3 – 2.7 are also to be met.

2.10 Should it be impractical to reduce EO holdings to achieve the IBD, the project sponsor must provide a dedicated safety case which will form the basis of the consultation, cooperation and coordination plan (EO CCC plan) of relevant activities showing:

a. Why it is not reasonably practicable to reduce EO holdings at the surrounding PES to achieve a separation distance of at least the IBD. Considerations for determining this may include EO required to be held to meet operational requirements, moving EO from PES introduces greater overall risk than retaining it in place. Any argument to retain EO in the PES must not rely solely on cost or time considerations.

b. The EO quantity has been reduced as far as reasonably practicable (SFARP),.

c. Any risk to EO being stored in adjacent PES from the construction work has been reduced SFARP.

d. Any additional risk reduction and/or mitigation arrangements required to reduce the risk to construction workers SFARP. This may include minimising the number of workers and time of exposure or handling time restrictions in adjacent buildings etc.

2.11 The intent of this EO CCC plan is to explore all possible options to reduce the constructions risks SFARP both to the construction workers and the surrounding facilities, including any EO that may be stored within, rate the identified risks and identify the most appropriate course of action. This is to include mitigation control measures and a means of ensuring that the control measures have been implemented.

2.12 Once the EO CCC plan has been developed it is to be endorsed by the Explosives Storage and Transport Regulator (ESTR) and retuned to the project manager for implementation.

2.13 Where an EO CCC plan is required, the project manager is to add a special condition to the construction contract. The special condition is to state:

a. In carrying out the works the parties recognise that contractor employees will work in the proximity of a PES and that there are inherent risks to the safety of those workers arising from the EO stored and deployed in buildings adjacent to where the Contractors Activities will be performed.

b. The Contractor agrees that it, its employees, sub-contractors and sub-contractor employees will perform work under this Agreement provided that:

(1) the parties and any relevant PCBU develop and participate in a dedicated plan regarding consultation, cooperation and coordination of relevant activities (EO CCC Plan);

(2) prior to any of the contractor's activities being performed in the vicinity of the EO facilities the EO CCC Plan must have been developed and agreed, and specific risk assessments jointly carried out addressing the risks relating to the performance of construction work in the vicinity of the EO facilities. Those risk assessments must specifically address the question whether EO stock relocation would create risks to Defence personnel/contractors engaged in relocation that is disproportionate to those explosives risks to the contractors employees should the EO remain in place;

(3) In all other respects the requirements of the DEOP 101 are to be complied with.

REPAIR AND MAINTENANCE

Repairs and maintenance of explosive ordnance facilities

2.14 The repair and maintenance of EO facilities is to be undertaken under the following conditions:

a. In Zones 0E, 1E, 2E or Zone 20E EO facilities, no repairs or maintenance of any kind to the structure or equipment are to be carried out while EO is in the building. In exceptional circumstances the OIC of the establishment may authorise the testing of electrical equipment to be carried out within the terms of Regulation 6.3 Procedure 1 and under the precautions/procedures specified in subparagraph b below (as appropriate).

b. In Zones 21E, 22E and Restricted Electrical Areas (REA) EO facilities minor repairs and maintenance are permitted without removing the EO, provided adequate protection against possible damage to the EO can be achieved by the facility supervisor. Where major repairs or maintenance are required and EO cannot be removed, the OIC of the establishment may permit work to proceed subject to the following requirements:

(1) The OIC of the establishment certifies that the removal of EO will cause unacceptable production delays and personally signs the Permit to Work for a

particular process. Guidelines for the preparation of a Permit to Work are given in Annex A.

(2) EO must be positioned at least 4 metres from the site of the repair/maintenance work. EO should also be moved away from the area of work where there is a possibility of damage, eg tools being dropped from a height onto explosive stores. Alternatively, and at the discretion of the OIC of the establishment, the EO may be adequately protected by provision of cushioning, catch nets or some other means, taking into account the EO risk involved, particularly where EO storehouses are concerned.

(3) Work on the EO is prohibited.

(4) The maintenance work area is to be defined by ropes or other means.

(5) Electrical supplies to powered equipment are to be isolated by removal of fuses or locking of switchboards, except when checking and maintaining installed electrical/electronic test equipment.

(6) Hand tools required for the maintenance task are to be recorded and checked on completion of the work.

(7) Leads from electrical appliances are to be positioned well clear of EO. A minimum distance of 0.6 metres is to be observed.

(8) The OIC of the establishment is to nominate a responsible person to be in attendance. The attendant is to be given instruction to ensure that no breach of EO safety instructions occurs and is to be empowered to stop the work if any unsafe practice is observed.

c. The items requiring repair whether fixed (eg walls, space heaters), or loose (eg tools), must be cleaned and inspected to ensure that no explosive contamination is present before work is allowed to commence. Cleaning can usually be effected by brushing and washing with hot water.

d. If articles have been subject to contamination, eg workbenches with metallic coverings, and retention of explosive dust is possible, then a special inspection is required to determine the presence and type of contamination.

e. All floors suspected of contamination are to be brushed and washed with hot water before being repaired.

f. Where work requires the use of heat generating devices a ‘HOT WORK PERMIT’ is to be approved by the OIC of the establishment. Local instructions are to be raised covering the procedures for the issue of hot work permits and ensuring hot work sites are declared free from hazards at completion of the work.

g. Adequate fire-fighting appliances are to be readily available when any repair involving the use of heat generating devices is being carried out in any EO building.

h. In EO buildings where fire detection systems and/or sprinklers are present local instructions are to address whether or not the fire alarm sector where Hot Work is taking place, is to remain active or is to be deactivated. This decision is to be based on local circumstances, the consequences of false alarms causing the call out of local fire services and the extent of water damage to equipment and stores if sprinklers are accidentally activated.

Standards of maintenance

2.15 All work in EO areas and facilities is to be under the supervision of, or undertaken by, appropriately qualified personnel.

2.16 When electrical work is undertaken a certification is to be obtained from the electrician that the work undertaken conforms to the electrical standard of the facility.

Vacation of explosive ordnance facilities for periods exceeding four months for work services

2.17 When a facility is temporarily removed from service for a period likely to exceed four months, eg for major repairs or modification, the OIC is to request the Licensing Authority to withdraw the Explosives Limit Licence for the facility in question.

Mechanical appliances and tools

2.18 Plant driven by internal combustion engines, stocks of oil or petrol for such plant (which are to be kept to a minimum), air compressors, pneumatic drills, and other such appliances and tools used in the construction, repair, and maintenance of roads and buildings are permitted, but must be addressed by the local instructions at paragraph 2.7. This is in addition to the conditions applicable to vehicle and mechanical handling equipment at Regulation 4.6 Procedure 2.

2.19 Mechanical appliances may only be taken into and used in EO areas subject to:

a. Provision of adequate first-attack firefighting equipment at the site;

b. Appliances being fully serviceable and, other than as stated in sub-paragraph c below, fitted with the necessary safeguards, eg spark arrestors (see Regulation 4.6 Procedure 2); and

c. Special appliances, which do not comply with the regulations for vehicles, etc, in EO areas, may be used provided that precautions are taken to minimise any consequent risks.

Maintenance of machinery and plant

2.20 The maintenance of machinery and plant is to be undertaken by the appropriate authority in accordance with Standard Maintenance Routines or other approved maintenance documents.

Repairs to roads

2.21 Roads into, and serving EO areas and facilities, are to be maintained in a good state of repair to lessen the risk of accident to vehicles and to minimise the entry of mud, grit, etc. into buildings, also see Regulation 4.4 Procedure 1 paragraph 1.42.

2.22 Those roads that are in direct support of aviation operations e.g. Ordnance Loading Aprons, EO Preparation Areas and in between, are to be constructed and maintained such that they keep the possibility of Foreign Object Damage (FOD) to an absolute minimum.

2.23 Speed limits are to be strictly adhered to, see Regulation 4.6 Procedure 2 paragraph 2.29.

Annex:
A. Permit to Undertake Maintenance Work in Explosive Ordnance Buildings with Explosives in Place (Guidance for Preparation)

ANNEX A

PERMIT TO UNDERTAKE MAINTENANCE WORK IN EXPLOSIVE ORDNANCE BUILDINGS WITH EXPLOSIVES IN PLACE (GUIDANCE FOR PREPARATION)

File Reference: ……………………….

PERMIT TO UNDERTAKE MAINTENANCE WORK IN EXPLOSIVE ORDNANCE BUILDINGS WITH EXPLOSIVES IN PLACE

1. The maintenance work detailed below is hereby authorised subject to strict observance of the precautions specified.

Building Number and Description:

……
……
…………………………………………………………………………………………

Work to be Done:

……
……
…………………………………………………………………………………………

Precautions to be Observed:

……
……
…………………………………………………………………………………………

a. **Demarcation of Work Area.** (The area where the work is to be done is defined and instructions given to ensure its segregation by roping off, flags or other means.)

b. **Location of Explosives during Maintenance Work.** (The positioning of explosive components and weapons is to be defined to ensure a clear minimum distance of four metres from the maintenance work. Work on explosives is to be prohibited. Electrical supplies to powered equipment are to be broken by locking of switchboards or removal of fuses – except when checking and maintaining installed electrical/electronic test equipment.)

c. **Fire Precautions.** (To be described and additional fire equipment listed.)

d. **Tools.** (All equipment and tools for the maintenance work, but alien to the normal process work are to be logged in and out. On completion of the work, the attendant member is to certify that all equipment and tools brought into the building for the maintenance task have been removed and that equipment worked on is properly closed up.)

e. **Supervision.** (A responsible officer is to be nominated to be in attendance while work is proceeding. Duties are to be defined and the officer must ensure that the terms of the Permit to Work are observed, and that no action is taken to breach explosive safety regulations. The officer is to have the authority to order work to cease immediately any unsafe practice is observed.)

Signature: ………………………………….

Name: ……………………………………….

Officer-In-Charge: ………………………….

Date: …………………………………………..

REGULATION 4.6 - PERSONNEL AND EQUIPMENT

General overview

6.1 Department of Defence has an obligation to ensure that its personnel can conduct their duties in a safe manner and environment. Through the provision and use of serviceable, applicable tools and aids, Defence endeavours to reduce the risk of an incident occurring thus ensuring personnel are able to complete their duties safely. Likewise all personnel have an obligation to adhere to the promulgated regulations and procedures which ensures that they contribute to the overall safety of the workplace.

Requirements

6.2 Personnel and Equipment are to be managed in accordance with the requirements of the Defence Safety Manual (SafetyMan) and this regulation including its associated procedures.

REGULATIONS

Personnel

6.3 A person is not to be employed in the Explosive Ordnance (EO) area unless the person is of suitable age, fit for duty, appropriately trained and authorised for such employment.

6.4 Hazards including potential hazards are to be identified, appropriately reduced and promulgated so that the user can be appropriately trained, so that they can conduct their duties in the safest possible manner.

6.5 Suitable Personal Protective Equipment (PPE) is to be supplied to the user when it is required to be worn.

Equipment

6.6 All equipment used in the processing, maintenance, and/or inspection of EO is to be assessed and approved for use by the relevant System Program Office/Authorised Engineering Organisation or equivalent agency and assigned an Australian Defence Force Logistics Manager (ADFLM).

6.7 MHE and Vehicles are to be classified and certified for use prior to being employed at any EO facility.

6.8 All mechanical handling, lifting, securing appliances and associated equipment is to be authorised, serviceable and within allowable test periodicity before being put to use in lifting and/or handling EO.

6.9 All MHE requirements including maintenance and testing requirements are to be document and/or listed in the applicable EO, platform or Service publication.

6.10 Results of tests conducted as specified by the maintenance program, if applicable, are to be documented and maintained for the life of the item.

6.11 Dedicated vehicles and specialised equipment is to be provided when required in support of EO activities.

6.12 Operation of MHE and vehicles are to be managed and controlled.

RESPONSIBILITIES

6.13 All persons employed or visiting an EO area/facility are to follow Defence’s work health and safety requirements.

6.14 It is the responsibility of each person to report to their Officer-in-Charge (OIC), a change in their personal circumstances or health status, should it occur, which may affect their suitability for the working role.

6.15 Personnel introducing equipment into service are to ensure hazards, conditions of use, operating procedures and any training requirements are identified and promulgated to the users of the equipment.

6.16 The OIC of a facility/establishment/assigned task is responsible to ensure that the requirements of this regulation are adhered to.

PROCEDURES

6.17 Procedures used to implement the requirements of this regulation are:

a. Procedure 1 – Personnel Working with Explosives, Explosive Ordnance and Associated Equipment.

b. Procedure 2 – Handling Equipment and Mechanical Aids including Vehicles for use with Explosive Ordnance and its Associated Equipment.

PROCEDURE 1 – PERSONNEL WORKING WITH EXPLOSIVES, EXPLOSIVE ORDNANCE AND ASSOCIATED EQUIPMENT

Introduction

1.1 Explosives and Explosive Ordnance (EO) is inherently dangerous if not treated correctly or maintained and operated outside their respective designed limitations. Therefore, employees involved with the maintenance, inspection, preparation and use of explosive ordnance are subject to certain restrictions and requirements that assist in ensuring a safe working environment is maintained.

Purpose

1.2 The purpose of this procedure is to specify the minimum restrictions, requirements and precautions for employees involved with the manufacture, maintenance, inspection and preparation of EO.

PERSONNEL EMPLOYED ON EXPLOSIVES AND EXPLOSIVE ORDNANCE RELATED TASKS

Personnel employed in explosive ordnance areas

1.3 A person is not to be employed in the EO area unless the Officer-in-Charge (OIC) of the establishment is satisfied that the person is suitable, appropriately trained and authorised for such employment.

Medical and mental suitability

1.4 The advice of a designated medical officer may be required regarding the medical suitability of persons selected for work in EO areas. The physical suitability and the mental stability of personnel is to be reviewed when necessary. Any suspected cases of addiction to excessive consumption of alcohol or drugs are to be referred to the medical officer for deliberation.

Restrictions on young persons

1.5 Before being selected for employment on EO work or in an EO area, a person must produce satisfactory evidence as to age. Whilst it is not intended to discriminate against personnel on the basis of their age, it is important that personnel employed on EO work be assessed as being sufficiently mature and competent to work on and/or handle EO, or that they are under appropriate supervision to do so. The OIC of the establishment is to be satisfied with the maturity of all personnel employed on EO work and is to take due cognisance of ‘duty of care’ requirements. As a guide the following may be used:

a. 18 years and over - Normally no restrictions will apply.

b. 16-17 year - Should normally work under supervision appropriate to the EO task being performed.

c. Under 16 years - Should not normally be employed on EO work.

Disabled persons

1.6 Discrimination against disabled persons on the grounds of their disability alone is forbidden by the *Disability Discrimination Act 1992*. Persons employed in EO facilities, however, require certain physical and mental capabilities in order to carry out their duties without hazard to themselves or to their fellow workers. This includes the ability to respond to emergency situations, such as the need to evacuate a building quickly, as well as carrying out scheduled tasks. Before employing a disabled person on any work involving EO, the OIC of the establishment is responsible for ensuring that the nature of the disability is not such as to cause risk either to the individual concerned or other personnel. The following guidelines cover specific disabilities.

1.7 Persons with physical disabilities which inhibit their use of first aid fire appliances or the rapid evacuation of buildings or areas should not be employed on work involving EO or on any work undertaken in the EO area.

1.8 Electrical hearing or other medical aids must meet the requirements of Regulation 6.3 Procedure 1. In no circumstances is any attempt to be made to remove or replace the battery of hearing or other aid in an EO area; the devices are to be adequately secured to ensure that there is no danger of dropping while in use and steps are to be taken to prevent inadvertent opening of the battery compartment.

GENERAL REQUIREMENTS FOR EMPLOYMENT

Induction into the workplace

1.9 Before commencing work in an EO area each person is to be formally inducted into the workplace by receiving adequate instructions on the basic safety precautions required in such an area. Personnel are to be made familiar with the action to be taken in an emergency such as explosion, fire or injury. Instructions to this effect are to be made known to personnel and steps taken to ensure that they understand them.

Compliance with regulations and procedures

1.10 Staff involved with the handling or use of EO are to comply with all regulations and procedures which may affect them in the course of their duties.

Disobedience of regulations

1.11 Any person who infringes or attempts to infringe, any of the explosives regulations and procedures is to be removed immediately from the EO area and not allowed to re-enter without the permission of the OIC of the establishment, who may also take disciplinary action against the person concerned.

Training and authorisation

1.12 All staff employed in an EO area are to be trained and authorised competent to undertake all the tasks which they may be required to perform, in accordance with the requirements of Regulation 1.1 Procedure 1. OICs are to ensure that continuation training programs are implemented to maintain levels of expertise in EO safety and fire-fighting.

WORK, HEALTH AND SAFETY

1.13 The *Work Health and Safety (WHS) Act 2011* requires, in part, that an employer:

a. Takes all reasonably practical steps to protect the health and safety at work of employees.

b. Provides and maintains a working environment and a workplace which is safe and without risk to health, and which provides adequate facilities for the welfare of employees at work.

c. Ensures the safety at work of employees and third parties, ie visitors, and the absence of risk to their health, in the use, handling, storage and transport of plant and substances.

1.14 The WHS Act also requires employees in part to:

a. Not create a risk or increase the existing risk, to the health and safety of the employee or of other persons at or near the workplace.

b. Use equipment in accordance with any instructions issued by the employer consistent with its safe and proper use.

1.15 Additional information on Defence's overarching policy, roles, responsibilities and requirements for WHS can be found in the Defence Safety Manual (SafetyMan).

Personal protective equipment

1.16 Defence management has a duty of care to take all practicable action to safeguard the health and safety of employees while they are at work. The provision of Personal Protective Equipment (PPE) will be adopted only after all other methods of direct control of hazards have been evaluated and excluded. The handling of explosives requires special precautions to be taken and specific types of PPE to be worn.

1.17 Prior to selection of PPE, the circumstances and restrictions of the task to be performed, the acceptable level of the hazard to which the worker may be exposed and the performance requirement for the PPE are to be assessed by way of a formal assessment.

GENERAL PERSONAL PROTECTIVE EQUIPMENT

Explosives workshop and guided weapon maintenance facilities staff

1.18 Staff employed in EO workshops and maintenance facilities operating under Classes 2 or 4 conditions (see Regulation 4.4 Procedure 5) are to wear the following PPE:

a. **Military personnel.** Service Uniform applicable to workshops.

b. **Civilian personnel.** APS staff and Defence Civilians are to wear the following types of dress:

(1) Operators:

(a) Satin drill or 100% cotton drill coveralls, shirt and long trousers or laboratory coats (shorts are not permitted); and

(b) Safety footwear or, if electrostatic hazards exist, anti-static or conducting safety footwear, as appropriate, in accordance with Regulation 6.3 Procedure 2.

(2) Supervisory or Quality Control Staff and Visitors:

(a) Satin drill or 100% cotton drill dustcoat or laboratory coat, and

(b) Sturdy footwear or, if electrostatic hazards exist, conducting shoes, conducting overshoes or leg-stats.

CAUTION

SHORTS ARE NOT PERMITTED TO BE WORN UNDER DUST OR LABORATORY COATS FOR SUPERVISORY OR QUALITY STAFF BUT MAY BE PERMITTED FOR VISITORS AT THE DISCRETION OF THE OFFICER-IN-CHARGE

1.19 All persons entering EO workshops operating under clean conditions (Classes 1 and 3) are to wear the clothing specified in Regulation 4.4 Procedure 6. This entails changing existing PPE to special issue PPE.

Other staff involved in maintenance or preparation of explosive ordnance

1.20 Staff employed on the maintenance and/or preparation of EO in areas other than EO workshops are to wear the following PPE as a minimum (see also Regulation 6.3 Procedure 2):

a. **Military personnel.** Service Uniform applicable to workshops.

b. **Civilian personnel.** APS staff and Defence Civilians are to wear the following types of dress:

(1) Satin drill or 100% cotton drill overalls or laboratory coat, and

(2) Safety footwear or, if electrostatic hazards exist, anti-static or conducting safety footwear, as appropriate, in accordance with Regulation 6.3 Procedure 2.

ADDITIONAL REQUIREMENTS FOR CONTACT WORKERS

1.21 Contact work is where powdered explosives are exposed or the process undertaken may generate explosive dust, or where high explosives, propellant and pyrotechnic substances or any mixture of such substances are exposed in any manner contrary to their normal use.

Contact work

1.22 All contact work is to be conducted under clean conditions (see Regulation 4.4 Procedure 6).

1.23 All appliances used on contact work are to be of an approved pattern and specified in the relevant maintenance instructions. Any variation for emergencies is to be authorised in writing by the Officer-in-Charge.

1.24 All areas where contact work is conducted are to be adequately ventilated. Ventilation arrangements may need to include an approved method for removing dust or fumes at the point of origin.

1.25 The floor, workbenches, trucks, trolleys and fittings or appliances on which explosive dust may accumulate are to be cleaned by an approved method at least once a day or more often if necessary. This applies in particular to the handles of all tools and appliances used in the operations.

1.26 Approved dust masks, face shields and disposable gloves are to be provided as required.

1.27 Personnel are to be provided approved means for:

a. Protecting the skin.

b. Cleansing any contamination from the skin.

1.28 Facilities complying with the latest WHS requirements are to be provided to enable contact workers to remove any traces of contamination.

1.29 Where employees duties are assessed such as they require medical monitoring, employees are to be examined or interviewed by an appointed medical officer before they are first employed on contact work. Those found to be suffering from pre-existing conditions are to be excluded. Subsequent medical examination/interview of contact workers is to be at intervals advised by the medical officer working conditions should be controlled, if possible, so that physical contact with explosive substances can be prevented. All cases of illness, rashes and skin pigmentation or skin disorders are to be reported to the medical officer.

1.30 No person returned to duty after medical suspension is to be employed in contact work without written permission from the medical officer.

1.31 No worker who is developing permanent conditions due to exposure to explosive substances is to work in contact with it again.

Additional requirements and precautions to be observed by contact workers

1.32 Every person employed on contact work is to deposit in the place or places provided, all clothing removed prior to work.

1.33 Every person is to wear approved clothing and protective gloves and respirators or face shields, if applicable, when employed on contact work and remove and deposit them in the place provided before eating or leaving the work place.

1.34 Contaminated clothing is not to be taken home for laundering, and must be cleaned by an approved contractor.

1.35 Before eating, going to the toilet, or leaving the work place, every contact worker is to wash in clean water in the wash place provided. The skin is to be cleaned with approved substances.

1.36 Fingernails are to be kept short and clean.

1.37 No person is to interfere in any way, without proper permission, with the means provided for the removal of vapour, fumes and dust from the workshop.

Posting of safety notice

1.38 The Officer-in-Charge is to have the requirements at paragraphs 1.32 to 1.37 inclusive, posted in each shifting room in a position where the notice can be easily read by contact workers – see Regulation 4.4 Procedure 6.

PROCEDURE 2 - HANDLING EQUIPMENT AND MECHANICAL AIDS INCLUDING VEHICLES FOR USE WITH EXPLOSIVE ORDNANCE AND ASSOCIATED EQUIPMENT

Introduction

2.1 Handling equipment and mechanical aids are common use items that assist in the safe movement of Explosive Ordnance (EO) and its associated equipment. Mechanical Handling Equipment (MHE), powered or not and also specialist lifting equipment such as cranes, present unique hazards to personnel and equipment when in use. Simple rules implemented surrounding the storage and operation of such devices will ensure that safe work conditions are likely to be upheld.

Purpose

2.2 The purpose of this procedure is to prescribe requirements and general management controls to minimise potential hazards when this equipment is used on EO in its authorised packaging, certain EO items outside the approved packaging and its associated equipment within, or close to, EO areas or facilities.

Overarching requirements

2.3 Defence's Work, Health and Safety (WHS) policy for plant is to be complied with in conjunction with the requirements of this procedure. The WHS policy can be found in the Defence Safety Manual (SafetyMan).

DESIGN, CONSTRUCTION AND SPECIFICATION OF VEHICLES AND POWERED MECHANICAL HANDLING EQUIPMENT

Zoning of potential explosion sites

2.4 EO buildings are classified according to the nature of EO stored, handled or processed in the building. Electrical installations and equipment are afforded the same category as the building in which they are installed or used. The same system is used to determine the protection to be afforded to vehicles and MHE permitted inside buildings containing EO. See Regulation 6.3 Procedure 1 for more information on Zoning.

2.5 Different categories of military diesel powered vehicles, diesel powered mobile MHE, electrically powered vehicles and electrically powered mobile MHE, are in some cases compatible, although some are not. Electrical requirements for MHE and vehicles are found in Regulation 6.3 Procedure 3 which includes a matrix clarifying the compatibility of the different standards, see Table 3-1 of Regulation 6.3 Procedure 3. Vehicles and powered MHE must not enter zones that they are not approved for.

2.6 **Identification of MHE[1].** Mobile MHE, including cranes, permitted to operate in Zones 1E, 2E, 20E, 21E, 22E and 33E hazardous areas, are to be clearly identified by suitable means such as sign writing, plating etc., to define the zones in which the MHE has been cleared for use. Mobile MHE used within Restricted Electrical Areas or Vehicles or powered MHE that have been hired for the activity need not be marked with this requirement.

Vehicles and MHE authorised to enter a potential explosion site

2.7 Electrically operated vehicles and MHE, including lifting or stacking appliances, are preferable from a safety viewpoint to those operated by internal combustion engines for use in EO facilities. Electrically operated vehicles and powered mobile MHE are permitted in a Potential Explosion Site (PES) subject to the restrictions detailed in Regulation 6.3 Procedure 3.

[1] Individual Services may have additional requirements for MHE EO certification.

2.8 Petrol engines are not permitted in a PES. However, military diesel powered vehicles and diesel powered mobile MHE such as compliant forklifts, are permitted in such facilities under certain specific conditions. Diesel engines that have petrol starting systems and vehicles powered by Liquid Petroleum Gas (LPG), butane or propane are to be treated as petrol engines and are therefore not permitted.

2.9 Details of the construction of petrol and diesel engine vehicles that are intended for the conveyance of Government and Visiting Forces' EO by road outside EO areas are contained in *Explosives Transport Regulations 2002 Statutory Rules No. 92, 2002* (ETR). These vehicles are not permitted into PES except as provided for in Regulation 6.3 Procedure 3, Annex B.

Vehicles and MHE authorised to enter explosive ordnance areas

2.10 LPG or LPG/petrol powered vehicles and MHE are not permitted for the handling and transportation of EO. They are permitted to enter EO areas to undertake tasks that do not involve explosives, eg a contractor required to work in an EO area, provided the conditions in this procedure governing the use of petrol engine vehicles are observed. They should not normally form part of the Defence fleet of vehicles required to regularly enter EO areas.

2.11 On certain occasions, an unprotected vehicle or unprotected powered mobile MHE is required to enter EO areas without entering a PES. The requirements for these unprotected vehicles are detailed in paragraphs 2.12 - 2.14.

Vehicles and MHE authorised to enter explosive ordnance areas without entering a PES

2.12 Privately owned vehicles may enter an EO area for the sole purpose of transiting personnel, provided that they are equipped with a fire extinguisher and do not present an increased fire risk. Authority for such vehicles is subject to the written permission of the Officer-in-Charge of the establishment. Privately owned vehicles are not allowed in a PES and are to be parked in designated car parks.

2.13 On certain occasions contractors are permitted to enter EO areas with vehicles and powered mobile MHE. Whenever possible the requirements of this procedure are to be met. Where the requirements cannot be met, the procedure incorporated in Regulation 4.5 Procedure 2 is to be adopted.

2.14 Emergency Vehicles. Subject to appropriate pre-planning by establishment emergency organisations, emergency vehicles are normally to be granted unimpeded access to EO areas. During an emergency practice or exercise, due regard to the content of this procedure is to be given.

Internal combustion engine

2.15 Internal combustion engines are to be Compression Lgnition (CI) engines. Cold starting fluids are only to be used in a permanently installed systems that inject fluid into the inlet air manifold downstream of (i.e. after) the inlet flame arrestor. The length and bore dimensions of any cold starting fluid injection jet are to be proportioned so that the jet is flameproof. Cold starting fluids are not to be used in conjunction with any electrical starting aids.

Fuel

2.16 Diesel fuel is to have a flash point of not less than 55°C. Other fuels may be used in diesel operated internal combustion engines provided that it has a flash point of not less than 38°C and the ambient temperature of the area in which the vehicle is working is at least 5°C below the flash point of the fuel. Due allowance is to be made for solar heat gain where vehicles are working in strong sunlight. The auto-ignition temperature of either fuel is to be not less than 250°C. All the temperatures above are derived from the Institute of Petroleum Method 170.

2.17 When fuels are used with additives (i.e. for cold climates) flash point and auto-ignition temperature will normally be reduced. Fuel and cold starting aid fluid is only to be carried in a fixed tank. No provision is to be made for the carriage of spare fuel or starting fluid.

Tyres

2.18 If the vehicle or MHE is to operate in an environment where static protection precautions are required (i.e. anti-static regime or conductive regime) then the tyre of at least one road wheel is to be electrically conducting in accordance with the requirements of BS2050:1978, Table 2, Item 8. All wheels on any one axle are to be fitted with tyres of the same type.

Ancillaries

2.19 Ancillary items in use with vehicles and powered mobile MHE are to comply with the equivalent standards as the main equipment with which they are utilised.

Maintenance and repairs

2.20 The manufacturer is to be required to provide a user's handbook, with each item of MHE, which includes the maximum performance limits of the equipment. A comprehensive maintenance schedule for the equipment must also be provided which details the periodic maintenance and testing required ensuring adequate continued explosion hazard safety.

2.21 All MHE is to be properly maintained and periodically tested in accordance with approved Motor Transport Servicing Instructions that take into account the manufacturers requirements.

2.22 MHE found to have any defect that may affect its safety is to be taken out of service until the defect has been rectified.

2.23 Following any maintenance or repairs to the exhaust system it must be reassembled with new gaskets and tested for leaks before the MHE is put back into service. Exhaust system flame emission tests are not required during routine maintenance.

Modifications

2.24 No unauthorised modification is to be made to any vehicle or MHE without written authorisation from the manufacture.

MANAGEMENT AND CONTROL OF VEHICLES AND POWERED MECHANICAL HANDLING EQUIPMENT

Serviceability

2.25 No unserviceable vehicle or powered MHE is to be permitted to enter an EO area. In this respect, particular attention should be paid to exhaust systems. Furthermore, if a fault is discovered on any vehicle or MHE during use that affects its safety, it is to be promptly withdrawn from use.

Speed and load limits

2.26 The maximum permitted speed and load limits for each type of MHE are to be fixed for each site by the Officer-in-Charge (OIC) of the Establishment, taking into account the manufacturers' published performance limits and other requirements as appropriate. The speed and load limits are to be appropriately promulgated.

Maximum rated capacity

2.27 The 'test before use' principle provides additional confidence that lifting appliances will not fail during Service use. On no account is the Maximum Rated Capacity (MRC) to be exceeded.

Parking

2.28 Vehicles and powered mobile MHE are not to be left unattended in a PES. Parked vehicles loaded with EO are required to be treated as a PES.

Garaging

2.29 Above ground garaging. Garaging of vehicles and internal combustion engine MHE in an aboveground EO facility is not to be within the Inter Magazine Distance of any PES.

2.30 Underground garaging. Vehicles and MHE used in underground sites should normally be garaged at a selected area aboveground. Where this is not possible, the Licensing Authority may authorise a selected area underground that is sited as far as possible from the explosives.

Breakdowns

2.31 Should a breakdown, including failure to start readily, occur in the vicinity of a PES, the vehicle or MHE is to be off-loaded of any EO and whenever possible, is to be moved a distance of a least 25 m from the nearest PES, before repairs are attempted. Normally only first-aid repairs of a minor nature, sufficient to permit the vehicle or MHE to be moved, are permitted within an EO area.

2.32 Vehicles or MHE requiring major repairs are to be removed to an approved repair facility.

Refuelling arrangements

2.33 Vehicles and MHE are normally only to be refuelled at authorised aboveground refuelling points and tanks are not to be filled beyond the specified capacity. No spare fuel is to be carried. Where refuelling points are authorised in underground sites, the fuel is to be taken underground in approved containers in sufficient quantities for one day's work only. The refuelling point is to have a floor of concrete impervious to fuel and a suitable method of spillage containment.

Fire fighting appliances and precautions

2.34 Vehicles and powered MHE are to carry fire extinguishers of types suitable for use against electrical fires and the particular fuel applicable to the vehicle or MHE. Additional fire fighting equipment is to be provided at PES where MHE is working, and garages, refuelling points and battery charging facilities.

Ventilation

2.35 Where vehicles and MHE are permitted in a PES, adequate ventilation is to be provided to remove exhaust fumes.

Loading/unloading of vehicles

2.36 The engines of all load carrying road vehicles are to be switched off during loading and unloading of EO unless the engine is required to facilitate the loading or unloading of the vehicle.

Mobile cranes, ship and barge mounted cranes and cranes not in regular use

2.37 All mobile cranes, ship/barge mounted cranes of all kinds and cranes not in regular use are to be subjected to the following tests before use:

a. All pre-use checks recommended by the manufacturer.

b. Testing of every crane motion for several minutes without load, each motion individually at first then by a combination of two or more motions simultaneously as appropriate, and then repeating the test with an inert load on the crane. For this test the load is to be at least equal to the maximum load to be handled. For mobile cranes the strength and stability of the crane at its location is important. The test should include simulating the maximum reach the crane would be required to move the load.

c. On floating cranes, the test lift (with load) is to be repeated after any break of one hour or more, or at any time when required by the ship's Commanding Officer's representative, the loading supervisor/master stevedore or the crane driver. The test lift is to be witnessed by a representative of both the loading and receiving parties.

d. Assurance is also to be obtained that cranes not in regular use are adequately maintained and that the probability of failure is at least equal to that which the crane would be afforded if it was subject to regular use.

REQUIREMENTS FOR NON-POWERED MECHANICAL HANDLING EQUIPMENT

2.38 General purpose equipment. General purpose lifting equipment is permitted to be used with EO items provided the items of EO are packed in their authorised packaging and the equipment is maintained and used as intended by the manufacturer i.e. in a serviceable condition and within its Working Load Limit (WLL) etc. An example of general purpose lifting equipment is a commercial of the shelf, pallet jack.

Note

> The authorised packaging referenced above means the packaging as listed in the Defence Explosive Ordnance Classification Listing (DEOCL). This includes robust items packaged on pallets such as 155mm.

2.39 Special to type equipment. Special to type lifting and handling equipment or bespoke equipment such as Guided Weapons maintenance trolleys, is only to be used for handling EO that it has been specifically designed for. Each item is to be authorised for use in applicable publications/orders etc., in a manner so that users can easily identify the item. Once authorised for use with EO, the approved equipment is not to handle or lift general goods. It is to remain as a dedicated EO lifting/handling apparatus.

2.40 All equipment must be surveyed, tested and maintained in accordance with the manufacturer’s recommendations and instructions for that particular item, before the item can be specifically designated as authorised for use. Where fitted, each appliance test plate or other suitable marking medium and all relevant documentation are also to be marked accordingly.

2.41 To ensure that all items are surveyed, tested and maintained at prescribed periodicities, an effective re-call system is to be implemented. Units are to maintain a complete list of approved MHE that they have within their facility or area of responsibility. The OIC of the facility is to ensure that each item is included in the effective re-call system.

2.42 Results of any tests conducted are to be recorded on individual appliances or equipment on a test plate or other suitable marking medium. Any equipment that fails testing is to be segregated and is not permitted for use. The following marking and test particulars are to be recorded as a minimum:

a. Unique identification number.

b. Date of the test/inspection conducted.

c. The outcomes of the tests conducted i.e. pass, WLL.

d. Date of the next test due.

e. Initials or identification mark of the testing officer.

2.43 Any appliance whose configuration includes hooks are to be fitted with a closed hook.

Action prior to use

2.44 The user and/or operator of any lifting and handling equipment for use in any activity involving EO, is to carry out the following checks, as a minimum, just prior to use:

a. Ensure the appropriate equipment that has been selected for use is authorised for the task in hand.

b. Check the appliance test plate to ascertain that the equipment is within its test period and suitable for the task required i.e. not operating outside the WLL, as identified via the test plate required by paragraph 2.42.

c. Inspect the equipment, including associated structural fittings, for any defects. Particular care is to be given to less endurable items such as wire ropes, cordage, splices, strops, and lifting and securing slings.

SPECIALIST ADVICE

2.45 Since the failure of equipment when lifting and handling EO can have catastrophic consequences, users or operators are not to hesitate to call in the specialist maintenance, survey and testing authorities for any defects found or suspected and/or for technical advice.

REGULATION 4.7 - EMERGENCY MANAGEMENT

General Overview

7.1 Potential exists for emergency situations and incidents, which may or may not involve or threaten Explosive Ordnance (EO) or Explosive Hazardous Areas (EHA), to escalate to become a catastrophic event. Emergency situations require immediate decisive management to ensure that undesirable situations are controlled.

Requirements

7.2 The emergency control arrangements resulting from these requirements are not intended to stand alone for EO activities and should be incorporated into the emergency arrangements of the establishment as a whole.

Emergency Control

7.3 Each major EO storage facility is to establish an Emergency Control Organisation comprised of an Emergency Control Committee (ECC) that is to be supported by an established Emergency Control Room (ECR) or area. The Manual of Fire Protection and Engineering (MFPE), details the requirements for each of the following:

a. **Emergency Control Committee.** An ECC is to be formed from within the staff resources of the unit/establishment.

b. **Emergency Control Room.** The ECR is to be staffed during all emergencies by the members appointed to the ECC.

c. **Emergency Response Plan.** The ECC is to formulate an Emergency Response Plan (ERP) appropriate to their facility, which will be followed in the event of an emergency. The ERP is to be promulgated in local instructions. In developing the ERP the reporting and investigating requirements for accidents, fires and explosions detailed in Regulation 1.3 Procedure 1 are to be incorporated.

d. **Training.** All staff is to receive annual instruction in the identification, operation and use of first attack firefighting and emergency equipment held by the facility.

e. **Practice Drills/Exercises.** Practice drills/exercises are to be conducted to simulate emergencies involving EO eg dropped EO, fire in EO workshops or storage areas, transport incidents, injuries to personnel from an explosion or exposure to toxic by-products, etc. In addition to the requirements of the MFPE, the following guidelines apply to the conduct of practice drills/exercises:

(1) All practice drills/exercises and the personnel who attended are to be recorded in the ECR Incident Log Book.

(2) Local arrangements must be in place to filter messages resulting from practice drills/exercises to ensure that outside assistance is not involved unnecessarily.

f. **Inspections and Reporting.** To supplement the Fire Safety Surveys required by MFPE, the unit/establishment fire officer accompanied by appropriate technical inspection staff (EO qualified Technical Officer) are to conduct quarterly fire safety inspections on major unit/establishment facilities. The results of these inspections and any rectifying actions are to be recorded in the ECR Incident Log Book.

g. **Housekeeping.** The highest possible level of housekeeping is to be maintained in EO storage areas.

7.4 **Familiarisation Visits.** Annual familiarisation visits by emergency services such as fire, medical and police, are to be encouraged providing security requirements can be satisfied.

Planning of Facilities

7.5 Emergency management aspects are to be incorporated into the planning of new facilities or upgrades to existing facilities eg Fire Safety. The following aspects are to be considered:

a. Alarms;

b. Fire Breaks;

c. Fire Fighting Equipment, including the maintenance of such equipment;

d. Emergency Communication Equipment;

e. Emergency Showers; and

f. Eye Wash Stations;

Control of Items

7.6 The following items require control in EHAs:

a. Fires;

b. Heating Appliances;

c. Boiler Houses;

d. Stoves;

e. Appliances/Tools used for repair Buildings or Static Equipment;

f. Fuel and Flammable Liquids;

g. Incinerators;

h. Smoking;

i. Electrical Power; and

j. Rubbish and Waste.

Responsibilities

7.7 All personnel employed on and around EO are to ensure compliance with this regulation and the associated procedures.

7.8 The OIC is to appoint suitable staff to the ECC.

7.9 The ECC is responsible for:

a. Formulating, promulgating and implementing all procedures associated with emergencies, eg Emergency Response Plan, including training, call-out and liaison with local emergency authorities. Procedures are to be based on local conditions and the requirements of the Australian Standard AS 3745-2010/Amdt 2-2018, MFPE, and this regulation; and

b. Controlling emergencies from the ECR.

7.10 Staff involved with the planning or upgrading of new/existing facilities is to ensure that the requirements of this regulation are incorporated into the building design as applicable.

Procedures

7.11 Procedures used to implement the requirements of this regulation are:

a. Procedure 1 – Fire Protection, Prevention and Fire Fighting Emergency Arrangements for Explosive Ordnance; and

b. Procedure 2 – Explosive Ordnance Emergency Arrangements for other than Fire.

PROCEDURE 1 - FIRE PROTECTION, PREVENTION AND FIREFIGHTING EMERGENCY ARRANGEMENTS FOR EXPLOSIVE ORDNANCE

Introduction

1.1 An outbreak of fire in the vicinity of Explosive Ordnance (EO), or amongst the EO itself, must be recognised as a potential source of extreme and immediate danger to life and property. It is of the utmost importance that fire protection and prevention measures are taken, and that the organisation is such that if a fire occurs it is responded to immediately and energetically in a planned and rehearsed manner. Personnel employed in or adjacent to an EO area must be made aware of the possible danger and how to operate the first attack firefighting equipment available.

Purpose

1.2 This instruction details procedures to aid in the development and implementation of fire safety practices in relation to EO, and in the event of a fire, an efficient and well-practised response. To this end, the subject is divided into three areas, namely:

a. **Fire Protection.** The design and construction of buildings and facilities to fire safety standards, the provision of fire detection and suppression systems, and the provision of first attack firefighting equipment.

b. **Fire Prevention.** The procedures adopted by occupants of facilities to reduce the risk of fire occurring, limit its spread, ensure that first attack firefighting equipment is available and serviceable, and to train occupants in evacuation procedures and the action to be taken in the event of a fire.

c. **Firefighting.** The action taken by specialist and auxiliary firefighting personnel to assess the circumstances surrounding the outbreak of fire involving EO and determine subsequent action relating to rescuing personnel, extinguishing the outbreak and limiting damage to facilities and materiel.

1.3 Minimum firefighting requirements applicable to Small Quantity Facilities (SQF) are detailed in Regulation 4.4 Procedure 13. Because of the vastly different conditions that may pertain to the various SQF, lesser conditions than those specified may be authorised on the licence for SQF at the discretion of the Licensing Authority.

FIRE PROTECTION REQUIREMENTS

General

1.4 Fire protection provisions for Defence EO facilities are addressed in the Manual of Fire Protection Engineering (MFPE). Additional requirements are dealt with at paragraphs 1.5 to 1.12.

Fire Safety Planning for New and Upgraded Explosive Ordnance Facilities

1.5 Matters which need to be considered in the formulation of fire safety plans for new EO facilities and the upgrading of existing facilities are explained in the MFPE.

1.6 Staff responsible for detailed planning of new EO facilities and the upgrading of existing facilities are to take cognisance of the requirements in the MFPE particularly in respect of undertaking an analysis of the site in question with a view to achieving the prescribed levels of fire safety. Advice is available from the sponsor of the MFPE.

1.7 The requirements for fire safety assessment are detailed in the MFPE, Chapter 17 paragraphs 17.5 and 17.6.

Fire Alarm System

1.8 An efficient alarm system should be installed which is to be audible throughout the whole EO area including inside of buildings. Power operated alarm systems are to be tested weekly, with scheduled times being notified to all concerned including civil authorities where appropriate.

Fire Breaks

1.9 Fire breaks may need to be established and maintained inside and adjacent to the EO area perimeter fence, throughout the EO area and around each EO facility as required by Regulation 4.5 Procedure 1.

Scales of Fire Fighting Equipment

1.10 Basic scales of firefighting equipment are prescribed in the 'Building Code of Australia'. Special minimum acceptable requirements with respect to first attack appliances, water supplies, water reticulation systems and other fire fighting resources for EO depots are detailed in the MFPE, Chapter 17. Particular note is to be taken of the requirement at paragraph 17.11 of the MFPE, that fire points within EO storage areas be equipped with extinguishers only in order to limit personnel to fighting a fire only at the insipient stage.

Maintenance of Firefighting Equipment

1.11 All hose and other firefighting equipment is to be maintained in accordance with the MFPE and AS 1851 AS 1851-2012/Amdt 1-2016 in its various parts.

Emergency Communications Systems

1.12 Emergency communication systems are to be tested regularly. The testing cycle is to be based on local conditions and the reliability of local phone systems.

FIRE PREVENTION ARRANGEMENTS

General

1.13 As the greatest threat to EO areas is fire, restrictions and precautions additional to those applicable to the establishment as a whole, are to be implemented. Details of the additional restrictions and precautions are given below.

Control in Explosive Ordnance Areas

1.14 **Fires.** Ideally the use of fires within EO areas should be completely forbidden, however it may not be practicable to impose an absolute ban due to the requirement to minimise ground fuel build-up by controlled burning. Fires may therefore be authorised subject to the conditions laid down in the following paragraphs and provided that:

a. The fire is authorised in writing by the OIC of the establishment if satisfied of its necessity, in consultation with Estate and Infrastructure Group (E&IG) Regional Fire Safety/Regional Environmental and Sustainability Officers (RESOs) and appropriate local authorities; and

b. The authorisation is withdrawn immediately the requirement ceases to exist.

1.15 **Open Fires.** Open fires are prohibited in buildings within EO areas.

1.16 **Heating Appliances.** Heating appliances within offices etc within the EO area are to be of the oil filled electric type or reverse cycle air conditioners complying with the requirements of Regulation 6.3 Procedure 1.

1.17 **Boiler Houses.** Boiler-houses are prohibited within EO areas, however oil fired heating plant in support of hot water heated air conditioning may be used.

1.18 **Stoves.** Combustion stoves are prohibited within EO areas.

1.19 **Liquid Fuelled Heating Appliances.** Liquid fuelled heating appliances are prohibited within EO areas.

1.20 **Repair of Buildings or Static Equipment.** The use of blowlamps or other heat or flame producing appliances within EO areas are to be strictly controlled subject to the provisions of Regulation 4.5 Procedure 2.

1.21 **Domestic Incinerators.** Domestic incinerators for the disposal of rubbish, classified waste paper etc are prohibited within EO areas.

1.22 **Incinerators for Disposal of EO.** Incinerators for the destruction of EO are not to be sited within EO areas, but in a separate licensed burning ground.

1.23 **Smoking.** Smoking is not permitted within EO areas and demolition or burning grounds except in places authorised and signposted by the OIC of the establishment as a 'SMOKING AREA'. (See Regulation 4.4 Procedure 1)

1.24 **Control of Smoking or Fire Lighting Materials.** Where smoking areas or fires are authorised, special arrangements are to be made for the conveyance of the controlled articles within EO areas. Lockable containers are to be used and the keys are to be held by a responsible person. (See Regulation 4.4 Procedure 1).

1.25 **Promulgation of Smoking Areas.** The OIC of the establishment is to promulgate in local instructions, the location of approved smoking areas and the arrangements for taking smoking materials into EO areas, demolition or burning grounds.

1.26 **Electrical Power.** All non-essential power supplies are to be switched off whenever EO buildings are not occupied.

Prohibited/Controlled Articles

1.27 Articles which are liable to increase the fire risk are not to be taken into EO areas unless special authority has been granted, except that materials such as paints, oils, solvents and cleaning rags essential for the maintenance or repair of EO may be used or stored in EO areas providing that these materials are handled strictly in accordance with the provisions of this manual. A list of prohibited and controlled articles is included in Regulation 4.4 Procedure 1. The conveyance of controlled articles within EO areas is to be regulated by local instructions issued by the OIC of the establishment.

Flammable Liquids

1.28 **Storage Overnight.** Under no circumstances are paints, solvents, paint brushes or similar articles and substances to be left in an EO building or anywhere within EO areas (except in an approved flammable liquid storage location) overnight. Opened containers of flammable liquids are not to be left unattended at any time.

1.29 **Approved Storage Locations.** Flammable liquids may be stored overnight within EO areas only if they are contained in flammable liquids storage cabinets designed and constructed to AS 1940, eg:

a. DSN 7125-66-066-5474 - Cabinet, Storage, Steel, Flammable Liquid, 3 shelf, 100 litre capacity; or

b. DSN 7125-66-066-5473 - Cabinet, Storage, Steel, Flammable Liquid, 3 shelf, 200 litre capacity.

1.30 Limitations on the Use of Flammable Liquids Cabinets. The use of flammable liquids cabinets is subject to the following criteria:

a. They are to be sited external to any EO building and at least 3 m from any building openings, eg doors or windows, and any electrical switch board or other possible ignition source;

b. If sited against a building wall, the wall is to be of fire-resistant construction, eg brick, concrete or metal cladding, with an air gap of at least 100 mm maintained between the cabinet and the wall;

c. They are to be sited on ground free of fire hazards;

d. They are to be located in a well ventilated area;

e. The quantities held in them are to be kept to the minimum required for day-to-day use as specified by the area supervisor, and regular checks are carried out to guard against excessive holdings;

f. The storage area is to be kept clean and free of soiled rags; and

g. The location is to be adequately provided with firefighting equipment.

1.31 Bulk Stocks. Bulk stocks of flammable liquids are not normally to be stored inside EO areas, but are to be stored in an approved external location such as a paint store or Depot Equipment Store, see Annex B, paragraph 12.

Spontaneously Combustible Materials

1.32 Articles liable to spontaneous combustion, eg oily rags, are not to be taken into an EO building containing EO except when required for immediate use. Such articles are to be disposed of in metal garbage bins with close fitting lids, and are to be cleared to a safe distance of 3 m from the EO building whenever it is vacated or work ceases for any period of time. At the conclusion of daily activities these materials are to be removed from the EO area for disposal. (See Regulation 4.4 Procedure 1).

Rubbish and Waste

1.33 Separate garbage bins with close fitting lids are to be provided for the disposal of other types of rubbish and waste. Such articles are to be cleared to a safe distance of 3 m from the EO building whenever it is vacated or work ceases for any period of time. (See Regulation 4.4 Procedure 1).

Environmental Management Plan

1.34 A balanced plan for estate management is to be implemented to reduce the risk of fire. The fire hazard may be reduced by the installation of fire breaks and the control of vegetation by grazing livestock, controlled burning, the selective use of herbicides or cutting. Regulation 4.5 Procedure 1 provides guidance on the creation of firebreaks and the control of vegetation.

Operations During Periods of High Fire Danger

1.35 All States of the Commonwealth have enacted various legislation restricting or prohibiting fires in the open during specific periods. Demolitions, including those conducted during EO disposal tasks, are deemed to be fires for the purpose of the various legislation.

1.36 The Department of Defence or the Commonwealth is not protected by any special legislation in this area. Therefore the Commonwealth in almost all circumstances would be liable for any damage caused by a fire which was started on Commonwealth property.

1.37 In light of the above, the following procedures are to be adopted:

a. All Defence establishments holding EO are to comply with fire restrictions imposed by state and/or Territorial Governments or agencies. No controlled burning is to be conducted during such periods.

b. If operations/exercises are required to be conducted during proclaimed high fire danger periods, establishments are to ensure that adequate firefighting resources are provided to minimise the risk of fire outbreaks spreading to adjoining non- Commonwealth property.

c. Officers controlling EO disposal operations are to ensure that appropriate measures are implemented to minimise the risk of fire occurring. Dependent on circumstances, either or both of the following are to be adopted:

(1) The local civil fire brigade is to be requested to attend the scene; and

(2) Response vehicles are to be equipped with portable fire extinguishers and/or knapsack sprays and appropriately trained staff is to be available to use that equipment if called to do so.

d. Establishments are not normally to conduct demolitions, destruction or proof during periods of high fire danger. If such operations are essential, adequate firefighting resources are to be provided to minimise the risk of fire outbreaks spreading to adjoining non-Commonwealth property.

FIREFIGHTING ARRANGEMENTS

General

1.38 Although departmental organisations such as E&IG are responsible for the provision of certain firefighting equipment and services, the Officers-in-Charge (OIC) of establishments are responsible for ensuring that adequate measures are in place for the protection of EO, and EO storage and handling facilities against the hazards of fire.

1.39 Since the initial reaction of personnel could be crucial in limiting the consequences of an outbreak of fire, all personnel involved with EO storage, handling and inspection are to be instructed annually on the application and use of first attack firefighting equipment. Note that the limitation of responsibility for firefighting by EO staff, ie nonprofessional firefighters, to the use of first attack firefighting equipment only is intentional. Personnel should never put their safety at risk by continuing to fight a fire if the EO is involved directly or is likely to be affected before the person(s) in attendance is able to retire to a safe distance.

Responsibilities

1.40 **Officers-in-Charge.** OIC of establishments are responsible for fire prevention and the firefighting organisation at their establishments - see MFPE. This responsibility includes the following:

a. The firefighting organisation in the establishment caters for all contingencies and is efficient;

b. Firefighting equipment is adequate, appropriate, well maintained and always ready for instant use;

c. The efficient training of personnel;

d. The maintenance of the required fire breaks within the EO area, see Regulation 4.5 Procedure 1;

e. Coordination of all available means, including the provision of suitable radio communications equipment, to ensure that any outbreak of fire is brought under control as quickly as possible;

f. Arrangements for the evacuation of all personnel to a safe place in response to a fire alarm; and

g. Fire orders are issued and kept up to date and that all personnel are made aware of their duties.

Commanding Officers of independently located units or detachments which provide their own services are responsible for the organisation and efficiency of fire services at those locations, the promulgation of their own fire orders and other applicable responsibilities given above.

Planning

1.41 Each establishment is to prepare a plan for fire prevention and firefighting to include efficient arrangements relative to the raising of the alarms, safe evacuation of personnel, fire fighting measures and the adequate identification of all EO facilities.

1.42 An Emergency Control Organisation that will react in the event of any emergency is to be established in accordance with the requirements detailed in MFPE.

1.43 Consideration is to be given to the possible need to involve local civilian emergency support authorities such as fire services, police, ambulance and hospitals and predetermined arrangements made as necessary.

1.44 A plan of the establishment showing the location and identity of each facility and the layout of the principal mains, including water, gases, electricity and telephone lines is to be maintained and be kept at strategic points on the establishment. For security reasons, the plan should contain only the minimum information necessary for effective firefighting.

Emergency Procedures - Fire

1.45 Detailed fire procedures that address, as a minimum, the aspects listed at Annex A, are to be prepared and issued to all sections and brought to the notice of all personnel. These procedures are to form part of the establishments procedures required by MFPE.

Firefighting Measures

1.46 Firefighting measures within an EO establishment call for close attention to detail and the coordination of all available means to ensure that an outbreak of fire is responded to immediately and energetically and brought under control as quickly as possible. These measures may be conveniently sub-divided as follows:

a. First attack measures,

b. Establishment measures, and

c. Civil authorities measures.

1.47 **First Attack Measures.** Firefighting 'first attack' measures are to be provided at an EO facility, or in the vicinity of an EO stack in the open. First attack measures may include firefighting appliances and local fire alarms for operation by those on the spot. The prompt use of these appliances may be the means of preventing a more serious incident, and all concerned must be trained to be fire conscious and capable of operating the equipment efficiently. However, note the requirements of paragraph 1.39.

1.48 **Establishment Measures.** Establishment measures may comprise, as necessary, the provision of firefighting media and equipment including adequate supplies of water from static supply and/or mains, fixed firefighting installations, hydrants, hoses, mobile fire appliances including pumps, positive pressure breathing apparatus, an efficient general fire alarm system, means of communication and trained firefighting personnel, according to the risk.

1.49 **Civil Authorities Measures.** Civil authorities measures are those taken by local fire and other authorities and may include the provision of all the normal equipment used by them, together with trained firefighting personnel.

Firefighting Responses

1.50 When a fire incident occurs involving EO, staff in attendance must immediately raise the alarm to activate the Emergency Control Organisation and then attempt to extinguish the fire if safe to do so using available first attack firefighting equipment. Subsequent firefighting actions will be determined in accordance with the prescribed emergency control arrangements.

1.51 The firefighting response is to be based on the guidance given in Annex C. Consideration of the following will be necessary prior to attempting firefighting action beyond first attack:

a. Classification(s) of EO involved in the incident, its reactions to fire and its strategic value;

b. Construction of the storage facility concerned and the type of traverses provided;

c. Capabilities of professional firefighters to respond to the incident;

d. Availability of protective areas from which to conduct firefighting operations;

e. Resources available both in manpower and equipment;

f. The likelihood of spot-fires occurring from blast residue or other storage facilities becoming involved as a result of fragments penetrating roofing, etc; and

g. Command, control and communications in place should further firefighting actions, additional to the original incident, be necessary.

1.52 Prompt application of firefighting measures will usually prevent serious fires. The following are intended to give general guidance:

a. Every effort must be made to prevent EO becoming involved in the fire. Firefighting may have to be carried out from behind substantial cover such as traverses, walls or buildings.

b. Radiant heat, sparks and flying embers from a fire are possible sources of spreading, therefore the damping down of EO, vehicles, buildings etc within range of the fire should commence early. Spray jets should be used for this purpose.

c. Wherever practicable, the fire should be fought from upwind.

Firefighting Classification of Explosive Ordnance

1.53 For firefighting purposes EO is divided into four fire divisions (Fire Divisions 1, 2, 3 and 4) according to its behaviour when involved in a fire. Fire divisions correspond to the hazard division of the EO concerned ie the second digit of the UN Hazard Classification Code for the particular store, eg Fire Division 2 for EO of HCC 1.2D, with the exception of substances and articles of HD 1.5 and HD 1.6 (see paragraph 1.57).

1.54 A description of the hazards to be expected during firefighting and the procedures to be employed in the fighting of fires in aboveground sites are detailed in Annex B.

Symbols for Fire Divisions and Supplementary Fire Symbols

1.55 Each of the fire divisions is identified by a distinctive symbol/sign in order that the explosive hazard involved can be easily recognised by personnel approaching the scene of a fire. A description and the use of these symbols together with details of supplementary symbols that indicate the precautions to be taken when fighting a fire are given in paragraphs 1.56 - 1.62 inclusive.

Fire Division Symbols

1.56 Fire division symbols are comprised of the word ‘Explosives’, a number (1.1, 1.2 or 1.3 indicating the Hazard Division of the EO concerned) and a bursting bomb within a square symbol standing on its tip. The background colour of the symbol is orange, and the writing, bursting bomb and number are in black. The Fire Division symbol for HD 1.4 has a background colour of orange, the word ‘Explosive’ and 1.4 in black writing (no bursting bomb symbol). These symbols are shown on the specimen of the Firefighting Poster Symbols Indicating the Fire Hazards of Explosives[1], in Annex C. Symbols are to have side dimensions not less than 250 mm.

1.57 Separate fire division symbols for HD 1.5 and HD 1.6 EO are not necessary since the reaction of HD 1.5 and HD 1.6 EO involved in a fire will be similar to existing fire divisions. Fire division symbols for substances or articles of HD 1.5 and HD 1.6 are to be displayed as follows:

a. HD 1.5 - display Fire Division symbol 1.3 or 1.1 (see Annex B, paragraph 2), and

b. HD 1.6 - display Fire Division symbol 1.2.

1.58 When EO of different fire divisions is stored at the same site, the symbol posted is to indicate the greatest hazard to firefighting personnel.

Supplementary Fire Symbols

1.59 Certain EO (pyrotechnic and toxic EO) and non-explosive dangerous goods require special supplementary fire symbols to indicate the precautions to be taken against the additional hazards created by their presence.

1.60 The supplementary fire symbols, except the Trefoil symbol, are shown on the Fire-fighting Poster[1] at Annex C and described in Annex D. Supplementary fire symbols are to have side dimensions of not less than 250 mm.

1.61 EO and non-explosives dangerous goods (NEDG) requiring supplementary fire symbols are indicated in Topic -025 of the item publication.

1.62 When required the supplementary fire symbols are to be displayed immediately below the fire symbol; where more than one supplementary fire symbol applies, they are to be displayed vertically in decreasing order of risk.

Location of Fire Symbols

1.63 Each facility containing EO is to have the appropriate fire division symbol, with supplementary fire symbols as appropriate, displayed on each vehicular approach to the facility. Care in positioning the symbol is to be taken to ensure that the view of the symbol is not obstructed by such things as traverses, vegetation etc. Additionally, in a compartmented building the supplementary fire symbol, if applicable to a compartment, is to be displayed adjacent to the door to that compartment. The symbol is to be located so it can be seen even if the door to the compartment is open. The fire division symbol is to be removed if the EO facility does not contain EO.

1.64 The method used to display symbols/signs is to provide for their easy removal or replacement as the need arises.

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[1] The NSN used to order the Symbols Indicating the Fire Hazards of Explosives Poster is 9905-66-120-6214.

Dangerous Goods - Placarding and Firefighting

1.65 Facilities containing dangerous goods (UN Classes 2 to 9), other than those NEDG identified in the Topic -025 of the item publication, are to be placarded using symbols for the relevant dangerous goods class shown in the Australian Code for the Transport of Dangerous Goods (ADG Code). Firefighting instructions are to be based on the HAZCHEM Emergency Action Code shown in the ADG Code.

Display of Firefighting Poster

1.66 The Firefighting Poster (Symbols Indicating Fire Hazards of Explosives) is to be displayed prominently at:

a. Main entrances to EO Storage Areas, and workshop and preparation buildings; and

b. Entrances to rooms or near Small Quantity Facilities licensed under Regulation 5.3 Procedure 1.

Annexes:

A. Local Fire Procedures - Essential Content
B. Firefighting - Hazards to be Expected and Actions Applicable
C. Symbols Indicating Fire Hazards of Explosives
D. Supplementary Fire Symbols

ANNEX A

LOCAL FIRE PROCEDURES - ESSENTIAL CONTENT

Local Fire Procedures must address, as a minimum, the following topics:

	Title	Essential Content
1.	Distribution	The distribution of local fire procedures.
2.	Responsibilities	The division of responsibilities for all key personnel involved in firefighting arrangements
3.	Fire Precautions	Fire precautions that must be enforced. Detail local orders about disposal of waste, grass cutting, search of buildings, fire inspections etc.
4.	Emergency and Firefighting Organisation	Details of the Emergency Organisation and its procedures; details of fire parties and mobile equipment they will man; assembly points, telephone numbers; arrangements for staff not in fire parties, viz, assembly points, mustering, first aid arrangements, transport etc for both working and silent hours.
5.	Command and Control between Depot Staff and Civil Authorities	Details of agreed arrangements for command and control when civil authorities (Fire and Police) are called for assistance.
6.	Training and Drills	Arrangements for periodical instruction and drills.
7.	Fire Exercises	Surprise drills and definition of responsibilities in each case.
8.	Maintenance of Equipment	Details of all periodical maintenance routines and tests with details of responsibilities in each case.
9.	Action in the Event of Fire	First attack action including the equipment to be used against the various types of fire. Methods of passing warning and sounding the fire alarm. Position and telephone numbers of people who must be notified. Details of persons responsible for calling in assistance from other parts of the depot. Emphasis on the importance of attacking a fire.
10.	Warning civil population of probable mass explosion	The procedure for warning the civil population in the surrounding area (EO storage depots only).
11.	Records	Detailed instructions governing the maintenance of records of all drills, tests, inspections and fires.
12.	Reports to be rendered after fire	Detailed instructions about the preparation and forwarding of reports.
	Annexes/Enclosures:	
A.	Equipment Lists	Complete details of equipment including reserves to be held in store.
B.	Key Telephone Numbers	A list of key numbers eg Local Fire Service, Hospitals, Police etc.
C.	List of EO Facilities	Generic description of use eg EO Storehouse, EO Workshop.
D.	Special Fire Poster	See Annex C.

Table 1A–1: Topics Required for Local Fire Procedures

ANNEX B

FIREFIGHTING - HAZARDS TO BE EXPECTED AND ACTIONS APPLICABLE

Fire Divisions – Hazards to be Expected During Firefighting

1. Since the fire divisions into which Explosive Ordnance (EO) is assigned also indicates its hazard division, the hazards to be expected during firefighting are those relevant to that particular hazard division, ie Fire Division 1 – hazards as for EO of HD 1.1; Fire Division 2 – hazards as for EO of HD 1.2 etc.

2. Fire Division 1 indicates the greatest explosive hazard. The hazard decreases with ascending fire division numbers as follows (but see Regulation 2.1 Annex A for a detailed description of hazards):

Fire Division	Hazard
1	Mass Explosion.
2	Explosion with projection hazard.
3	Mass fire or fire with minor blast or projections.
4	Moderate fire – no significant hazard.
5 (Symbol 1.3 or 1.1 displayed)	Mass fire with low probability of burning to detonation (display Symbol 1.3) unless a very large quantity of explosive is highly confined eg ship cargo or Igloo storehouse, (Display Symbol 1.1).
6 (Symbol 1.2 displayed)	Fire and heat with no mass explosion hazard but with a low probability of single article explosion with projections.

Table 1B–1: Fire Divisions and expected Hazards

Firefighting in Aboveground Sites

3. Definition of Aboveground Site. For the purpose of fire prevention and firefighting, aboveground sites are those where EO is above ground level and includes sites where part of the stored EO are below ground level.

4. Actions Applicable to All Fire Divisions. The following actions by firefighters are applicable to all fire divisions, regardless of the hazard division and explosive effects:

a. The fire alarm must be sounded and fire services notified. All non-essential personnel are to be evacuated from the scene of the fire, in accordance with the pre-arranged plan, to a sufficiently safe distance, eg at least Inhabited Building Distance.

b. If the fire is detected before the EO is involved, prompt action with 'first attack' firefighting equipment is to be taken to prevent the development of a serious fire. However, if the EO has become involved all personnel must immediately evacuate to a safe distance.

c. The actions of the firefighting services are to be directed towards preventing EO from becoming involved in the fire.

5. Actions for Fire Division 1. In addition to those actions at paragraph 4, the following actions and precautions apply in the event of a fire in facilities designated by the Fire Division 1 symbol:

a. A fire involving EO of HD 1.1 is to be fought during the initial stage with all available means and without awaiting specific instructions. If the fire cannot be immediately controlled, the scene of the fire is to be evacuated at once. EO in this division is expected to explode en masse very soon after the fire reaches it, and of major concern must be the protection of personnel and their equipment from blast, heavy debris and high speed fragments.

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b. A fully developed fire that has involved HD 1.1 EO is not to be fought unless it is known:

(1) What types of EO are stored at the scene of the fire,

(2) How long the EO may be exposed to a fire before it explodes, and

(3) How long the EO has been exposed to the fire.

In general, cased ammunition without its own means of initiation can be expected to explode within two to three minutes of the fire reaching it. However, initiators, igniters, propelling charges and rocket motors are extremely sensitive to fire.

c. Buildings containing EO of HD 1.1 should not be entered if smoke is visible from outside the building and where the EO is likely to be involved.

d. Vehicles loaded with EO of HD 1.1 should be abandoned if smoke is visible in the load compartment.

e. If a mass explosion occurs, action is to be confined to preventing the involvement of adjacent buildings and stacks by the application of cooling sprays when safe. Reaction fire suppression systems where fitted on adjacent buildings may be operated.

f. After an explosion, the firefighting forces may approach the scene only if the EO has been completely destroyed by the mass explosion so that only debris is left burning. Qualified EO disposal personnel should assess the safety of the scene before anyone is allowed to approach the area.

6. Actions for Fire Division 2. In addition to those actions at paragraph 4, the following actions and precautions apply in the event of a fire in facilities designated by the Fire Division 2 symbol:

a. If in the initial stage the fire cannot be controlled, the scene of the fire is to be evacuated. EO contained in this division is not expected to explode en masse. Immediately after the fire reaches it. EO of this division gives rise to sporadic explosions. The explosions will increase in intensity as the fire continues. Water should be applied freely to cool those items, which may be ignited by hot fragments, fire brands, lobbed items and self-propelled stores.

b. Buildings containing EO of HD 1.2 should not be entered if a significant volume of smoke is visible from outside the building and where the EO is likely to be involved.

c. Vehicles containing EO of HD 1.2 should be abandoned if a significant volume of smoke is visible in the load compartment.

d. If the fire cannot be extinguished before the first explosions are expected, firefighting services must stay sufficiently far away from the scene of the fire to be protected from the hazards of hot fragments, fire brands, unexploded and self propelled items which may be projected and explode on impact. If possible, they should move behind substantial cover (buildings, traverses etc) from which they can fight fires propagated in the vicinity of the original fire. If no adequate cover is available, they should retreat from the scene to a distance approximating the Process Building Distance.

e. Reaction fire suppression system where fitted in buildings endangered by the risk of penetration by hot fragments may be operated.

f. After the fire, advice of qualified EO disposal staff is to be obtained prior to firefighting services approaching the scene of the fire. An approach is only to be made after all signs of smoke have been extinguished.

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7. Actions for Fire Division 3. In addition to those actions at paragraph 4, the following actions and precautions apply in the event of a fire in facilities designated by the Fire Division 3 symbol:

a. A fire involving EO of HD 1.3 is to be fought at once during the initial stage with all available means and without awaiting specific instructions. If, in the incipient stage the fire cannot be controlled, the immediate area of the fire is to be evacuated. EO contained in this division has only a minor explosion effect.

b. Buildings containing EO of HD 1.3 are not to be entered if smoke or flame is visible from outside the building.

c. Vehicles containing EO of HD 1.3 are to be abandoned if smoke or flame in the load compartment is visible.

d. A fully developed fire is not to be fought from nearby because of the hazards of intense heat. If such a fire cannot be extinguished in the initial stage, firefighting services must stay sufficiently far away from the scene of the fire to be protected from hazards which range from items burning violently and giving off intense thermal radiation, to items burning sporadically with minor explosions. The scattering of firebrands and burning debris may be expected. If possible firefighting services should move behind substantial cover (buildings, traverses etc) from which they can fight fires propagated in the vicinity of the original fire. If no adequate cover is available, they should retreat from the scene of the fire to a distance approximating the Process Building Distance.

e. After a fire, the advice of qualified EO disposal staff is to be obtained prior to firefighting services approaching the scene of the fire. An approach is only to be made after all signs of flame have been extinguished.

8. Actions for Fire Division 4. In addition to those actions at paragraph 4, the following actions and precautions apply in the event of a fire in facilities designated by the Fire Division 4 symbol:

a. A fire involving EO of HD 1.4 is to be fought at once in all cases and with all available means and without awaiting specific instructions. EO contained in this division is mainly a moderate fire hazard and, after an extended period of time, may explode sporadically.

b. Care should be taken when entering buildings or approaching vehicles containing EO of HD 1.4 because of the hazards of fragmentation in the vicinity of the fire.

c. After extended periods of time EO may explode sporadically. For protection against fragments and missiles, firefighting services should not approach the scene of any fire closer than necessity dictates and certainly not closer than 25 m. When possible the fire should be fought from a protected location.

9. Action for Fire Division 5. In addition to those actions at paragraph 4, actions and precautions prescribed for Fire Division 1 (see paragraph 5) or Fire Division 3 (see paragraph 7) apply.

10. Action for Fire Division 6. In addition to those actions at paragraph 4, actions and precautions prescribed for Fire Division 2 (see paragraph 6) apply.

11. Metallic Powders. Stocks of metals which are sometimes used in powder form as ingredients of explosive compounds, and hence may be located in EO areas constitute a special risk because they are capable of burning fiercely and reacting violently with water. Consequently, a fire involving metallic powders is to be fought in a manner prescribed below and the precautions given are to be observed:

a. Among the substances suitable for use on the majority of metallic powder fires are powdered graphite, talc, soda ash, limestone and sand, all of which must be in a dry state. The extinguishing agent should be carefully spread on to the fire, starting from outside the burning area and working towards the centre, using long-handled scoops or shovels. The utmost care is necessary to avoid any disturbance of the burning powder until it has cooled below its ignition temperature.

b. Suitable dry chemical powders may also be used in bulk form, as above, or from portable extinguishers having low velocity, long-reach discharge applicators, subject to the dry chemical being non-hygroscopic and not unduly toxic.

c. Water and other extinguishants must not be used. A ‘Use No Water’ supplementary fire symbol is to be conspicuously displayed at each building as appropriate.

12. Dangerous Goods. The storage of dangerous goods (other than those non-explosive dangerous goods managed in accordance with Regulation 4.3 Procedure 1) in EO areas should normally be avoided. Specific approval for such storage is to be given by the Officer-in-Charge of the establishment, and the items are never to be stored in the same building as EO. The presence of dangerous goods must be clearly indicated in firefighting plans.

13. Firefighting Action - Summary. A summary of firefighting actions to be taken in the event of a fire, for each fire division, is given in the Fire Poster at Annex C.

ANNEX C

SYMBOLS INDICATING FIRE HAZARDS OF EXPLOSIVES

FIRST AID FIRE FIGHTING DURING STORAGE

Notes:

1. The action advised applies to all modes of ammunition storage, including buildings, open sites, field stacks, underground storage and vehicles

2. Where supplementary symbols are displayed with fire division symbols, the indicated or alternative action is to be taken.

HAZARDS

1. Explosive ordnance indicated by this symbol is expected to explode en masse very soon after the fire reaches it.

2. Major hazards will be from high velocity fragments, blast and projected structural debris.

ACTION

1. Sound Alarm.

2. Fire detected in the early stage are to be fought with all available means. If unsuccessful evacuate to a place of safety.

3. No attempt should be made to fight the fire after it reaches the explosive ordnance.

4. All non-essential personnel are to evacuate the area.

HAZARDS

1. Explosive ordnance indicated by this symbol is not expected to explode en masse. Initially there will be small sporadic explosions which will increase in frequency and intensity as the fire continues.

2. Hazards will be from hot fragments, fire brands, unexploded and self-propelled items which may be projected and explode on impact.

ACTION

1. Sound Alarm.

2. Fire detected in the early stage are to be fought with all available means. If such a fire cannot be extinguished, the scene of the fire is to be evacuated and firefighting concentrated on preventing the spread of fire to other exposed sites.

3. All non-essential personnel are to evacuate the area.

HAZARDS

1. Explosive ordnance indicated by this symbol has a minor or no explosion effect.

2. The hazard may vary from items which burn violently giving off intense thermal radiation to items which burn sporadically with minor explosions. The scattering of fire brands and burning debris may be expected..

ACTION

1. Sound Alarm.

2. Fire detected in the early stage are to be fought with all available means. If such a fire cannot be extinguished, the site is to be evacuated and firefighting concentrated on preventing the spread of fire to other exposed sites.

3. Take full advantage of any available protection from radiant heat.

4. All non-essential personnel are to evacuate the area.

HAZARDS

1. Explosive ordnance indicated by this symbol is mainly a moderate fire hazard.

2. Minor explosion may occur but there will be no blast and fragments will be limited to the vicinity of the fire.

ACTION

1. Sound Alarm.

2. Fire detected in the early stage are to be fought with all available means. If such a fire cannot be extinguished, full advantage is to be taken of any available shielding during continued action.

3. All non-essential personnel are to evacuate the area.

SUPPLEMENTARY FIRE SYMBOLS

Protective Clothing
No. 1

This comprises self-contained breathing apparatus, impermeable head covering, coveralls, gloves and covers footwear also protective footwear and undergarments.

Casualty/Toxic Agents

Protective Clothing
No. 2

This comprises self-contained breathing apparatus, coveralls, and protective gloves. Must be worn when fighting fires involving harassing agents.

Harassing Agents

Protective Clothing
No. 3

This comprises self-contained breathing apparatus, flame resistant coveralls and gloves. Must be worn when fighting fires involving white phosphorus and other spontaneously combustible materials.

Smoke and flame emission for WP, HC, Illum and pyrotechnic stores

No Water to be used.

This symbol indicated situations where the application of water is
NOT TO BE USED.

Metallic Powders

NOTE: COLOURS SUBJECT TO FADE ON THIS SIGN

ANNEX C

ANNEX D

SUPPLEMENTARY FIRE SYMBOLS

1. Due to the peculiarity of hazardous substances in certain types of ammunition (Compatibility Groups G, H, J and L), the storage of this ammunition may require supplementary symbols. Those supplementary 'Chemical Hazard Symbols' are used to indicate the precautions to be taken against the additional hazards proceeding from the chemical agents of that ammunition.

2. These supplementary fire symbols are described below:

a. **Protective Clothing Set No 1 (PC1) – Figure Wearing Protective Suit (red on blue circular background, see figure 1 below).** This symbol advises the need to wear protective clothing designated as PC1. In general terms PC1 consists of:

(1) Self contained breathing apparatus;

(2) Undergarments;

(3) Coveralls;

(4) Impermeable suit, hood, boots and gloves; and

(5) Protective footwear.

PC1 is to be worn for incidents involving EO that produces nerve and/or blister agent hazards.

b. **Protective Clothing Set No 2 (PC2) – Figure Wearing Protective Suit (yellow on blue circular background).** This symbol advises the need to wear protective clothing designated as PC2. In general termsPC2 consists of the following, as a minimum:

(1) Self contained breathing apparatus;

(2) Coveralls, which includes normal uniform with long sleeves, overalls with long sleeves and working dress/protective dress with long sleeves; and

(3) Protective gloves.

PC2 is to be worn for incidents that produce harassing agent hazards, eg hazards from tear and vomiting/choking gases and screening smokes.

c. **Protective Clothing Set No 3 (PC3) – Figure Wearing Protective Suit (white on blue circular background).** This symbol advises the need to wear protective clothing designated as PC3. In general terms PC3 consists of the following, as a minimum:

(1) Self contained breathing apparatus;

(2) Flame resistant coveralls; and

(3) Flame resistant gloves.

PC3 is to be worn for incidents involving EO filled with White Phosphorus (WP) or other spontaneously combustible substances. Hazards are from burning WP or similar substances and toxic fumes.

d. **Use No Water Symbol – Water from a bucket being emptied onto a fire negated by a red circle and diagonal band (on a white background).** This symbol advises that water must not be used as a firefighting medium at that location.

ANNEX D

e. **Trefoil (Radiological Hazard) Symbol.** The Trefoil symbol advises that radioactive materials are present in addition to the explosive hazard. The fire must not be approached. Copious quantities of water should be applied preferably from a protected, upwind location. The symbol is to be displayed together with one of the protective clothing symbols.

Figure 1 – Supplementary Fire Symbols

NOTE

Since the types and quantities of stores which require the use of the Trefoils symbol are few, the Trefoil symbol has not been included on the Fire Poster at Annex C. Trefoil placards are available through the normal supply system. There is currently no EO in the Defence inventory that requires the display of the Trefoil symbol.

PROCEDURE 2 - EXPLOSIVE ORDNANCE EMERGENCY ARRANGEMENTS FOR OTHER THAN FIRE

Introduction

2.1 Explosive Ordnance (EO) although designed to be safe for normal handling and use, storage or transport can present a serious potential for casualties and damage to property in various emergency situations. Fire is the more commonly considered emergency however; there are many other emergencies that are more likely to arise when dealing with EO. It is important therefore that there are Emergency Response Plans in place to deal with any such emergencies.

Purpose

2.2 This procedure specifies the requirements that need to be addressed in preparing procedures for emergencies other than fire that is addressed separately in Regulation 4.7 Procedure 1.

General

2.3 There are many emergencies other than fire that could occur during handling and use, storage or transportation of EO. The following emergencies are likely possibilities:

a. Dropped EO.

b. Spillage of explosive substances.

c. EO incidents during maintenance and inspection activities.

d. EO incidents during loading or transfer operations such as at wharves and buoys.

e. Improvised Explosive Device incidents.

f. Bomb threats.

g. Off Base EO transport incidents.

h. On Base EO transport incidents.

i. Hazardous material incidents.

j. Sabotage

k. Flood.

l. Civil Unrest.

m. Break–in.

n. Damage to structures due to storms or other catastrophes.

2.4 Since the method for dealing with any one of the above listed emergencies will vary from establishment to establishment, it is essential to anticipate the possibility of such emergencies and that detailed local plans be developed and promulgated. These plans should address as a minimum:

a. Procedures for:

(1) Activation of emergency control arrangements as required in Regulation 4.7,

(2) Control of the emergency, and

(3) Management of casualties;

b. Initial incident reporting requirements;

c. Protective clothing required to deal with the incident;

d. Seeking specialist advise;

e. Dealing with EO or hazardous substance involved;

f. Clean-up of incident site;

g. Follow-up incident reporting;

h. Notification of civilian emergency authorities, eg police; and

i. Media releases through Defence Public Relations.

Practice Drills/Exercises

2.5 Practice drills/exercises are to be conducted to simulate emergencies involving EO eg dropped EO, fire in EO workshops or storage areas, transport incidents, injuries to personnel from an explosion or exposure to toxic by-products, etc. In addition to the requirements of the Manual of Fire Protection Engineering 2018 (MFPE), the following guidelines apply to the conduct of practice drills/exercises:

a. All practice drills/exercises and the personnel who attended are to be recorded in the ECR Incident Log Book.

b. Local arrangements must be in place to filter messages resulting from practice drills/exercises to ensure that outside assistance is not involved unnecessarily.

REGULATION 4.8 - STOCK MANAGEMENT

General Overview

8.1 Effective stock control procedures are essential to ensuring adequate levels of safety, security and accounting within Explosive Ordnance (EO) storage facilities. Procedures developed should ensure that personnel operating within the storage facility have an overview of the entire stock management system and their role within it.

Requirements

8.2 Stock management of EO is to be conducted in accordance with this regulation and its associated procedures.

Stock Management

8.3 Items of EO are to be actively managed and able to be accounted for at all times. Units are to hold only the stock that they are entitled to and require for completion of the assigned tasking. Any EO surplus to requirements is to be returned to the nearest EO Depot at the earliest available opportunity.

8.4 EO of the same lot number should be stored together in clearly identifiable stacks as far as practicable. Stack record forms may be used, except in EO Depots where they are optional, and in physically small SQFs.

8.5 IT Logistics Management Systems are to be utilised where available in accordance with the procedures for that system.

Inspection of Explosive Ordnance on Receipt

8.6 All EO that has been received from user units should be given an inspection to ensure that it is the correct type and quantity expected, and is in a satisfactory condition for the assigned task, be that item use or general storage as the case may be. This principle applies to both user units and EO Depots alike.

Responsibilities

8.7 All personnel involved in the management of stocks within an EO facility are to ensure compliance with this regulation and its associated procedure.

Procedures

8.8 Procedure 1 – Stock Management for Explosive Ordnance provides detailed information required to implement the requirements of this regulation.

PROCEDURE 1 - STOCK MANAGEMENT FOR EXPLOSIVE ORDNANCE

Introduction

1.1 Effective stock control procedures are essential to ensure adequate levels of safety, security and accounting within Explosive Ordnance (EO) storage facilities. Procedures developed should ensure personnel operating within the storage facility are provided with a clear overview of the entire stock management system and their role within it.

Purpose

1.2 This procedure prescribes the requirements for the stock management of EO within EO facilities including types of, the use of and applicability of stock management forms.

Ordering, managing and returning EO

1.3 The Electronic Supply Chain Manual (ESCM) Volume 04 Section 08 Chapter 01 details the following requirements associated with the management of EO:

a. Security, in conjunction with the requirements of the Defence Security Manual;

b. Accounting;

c. Ordering;

d. Issue;

e. Receipt;

f. Transfer; and

g. Return.

1.4 **Stocktaking.** Stocktaking of Defence EO is to be conducted in accordance with Defence Logistics Manual (DEFLOGMAN) Part 2 Volume 5 Chapter 17 – *Stocktaking of Defence Assets and Inventory*.

1.5 **IT logistics management systems.** The computer based system known as Computer Support for Armament, normally referred to as COMSARM, is the primary stock management system for the EO inventory in Defence. Some single Service units also manage EO stocks via the Military Integrated Logistic Information System (MILIS). Those establishments with access to COMSARM or MILIS are to maintain stock records in accordance with the procedural instructions for those systems.

1.6 **Logistics codes for EO.** Logistics codes are used within stock management systems to assist with the organisation of stock. Logistics codes consist of the following two types:

a. **Condition code.** A Condition Code is applied to EO to describe its physical state or condition, i.e. serviceability status. Further information relating to condition codes can be found in Regulation 2.3 Procedure 4 Annex B.

b. **Account code.** An Account Code is applied to EO within the COMSARM stock management system and is used by inventory managers to segregate stock into discrete groups to facilitate its management. Further information relating to account codes can be found in the Electronic Supply Chain Manual (ESCM) Volume 13 Section 9 Chapter 10.

1.7 Establishments/units without access to COMSARM or MILIS are to maintain stock records in accordance with authorised single Service stores management instructions. Alternatively implement a physical card system for the management of stock within the storage area, i.e. stack record forms (see paragraph 1.22) and an EO content board (Regulation 4.4 Procedure 2).

1.8 **Issuing EO from an EO depot to HMA Ship and Submarines.** When issuing EO from an EO depot to a HMA ship or submarine the major stores comprising the outfit are to be made up of a number of Lots so that if a restriction is placed on one Lot the ship will have sufficient EO from other lots to continue with training and operational commitments.

In-Storehouse Practices

1.9 EO of the same lot number should be stored together in clearly identifiable stacks as far as practicable. Regulation 2.3 Procedure 7 provides guidance on unit loads, including specific marking requirements. Where multiple lot numbers of the same EO are held, each lot number is to comprise a separate stack, unless this is not possible due to the lack of storage space. Oldest lots should be most accessible, as these are to be issued first.

1.10 EO in any stack or building is to be so arranged that it can be readily identified. The serious consequences of confusion, especially under active service conditions are obvious. To this end EO is to be stored separately according to its Condition Code, identified by a stack card and when required is to be appropriately marked, e.g. Repairable labels are to be displayed on the stock if the stock is awaiting the completion of maintenance or repairs.

1.11 Regulation 4.1 Procedures 8 and 9 contain guidance for the stacking of EO.

Turnover of Stock

1.12 EO deteriorates with age, becomes less effective in use, and in some instances, more dangerous to handle and store. The rate of deterioration of certain items of EO is hastened by poor storage conditions or extremes of temperature, and guidance to ensure a reasonable life for such explosives is given in Regulation 4.1 Procedures 3 and 4.

1.13 In addition to deterioration by age, poor storage conditions and extremes of temperature, the holding of old 'Lots' and 'dates' of EO necessitates additional inspection and surveillance with the consequent gradual diminution of the stocks held.

1.14 In some instances, the combination of maintenance cycle and the complexity and duration to complete the maintenance task, demands that certain items of EO be fitted to parent equipment before the remaining 'storage' life of the item falls below an arbitrarily fixed level. If the items are not fitted before this level is reached, the fitment of the items becomes uneconomical or, is considered managerially unsound practice. In such instances, the items will 'storage' life expire without being fitted for use.

1.15 Once an item of EO's life expires, be that service or storage life, the item is to be returned to the nearest EO depot. Should the life expired item be desired for training purposes, such as demolition refresher training, the relevant item manager at the EO Management Agency is to be contacted for approval to draw life expired stores out of the depot.

1.16 To avoid unnecessary wastage from these causes, a regular turnover of stock is essential stockholders at both EO depots and user establishments are to ensure that the oldest stock is issued first.

1.17 Stockholders are to take the opportunity whenever possible to reduce holdings of small Lots. For gun ammunition this may be achieved by issuing mixed Lots to Gunnery Ranges as the operation of Ranges usually is not unduly affected by this practice.

1.18 **Exceptions.** To ensure that EO in overseas establishments and to Forces on Operations has as long a life as possible, and to avoid the necessity of replacing at short intervals, stock which has become unserviceable through deterioration by age, issues to such establishments and Forces are to be made from the newest stock, and should also exclude stock earmarked as 'firstissue'.

Explosive Ordnance being Received

1.19 All EO that has been received is required to be inspected to ensure that the correct type, quantity and the expected condition has been delivered. This is to be compared to the issue or return voucher accompanying the delivery. Refer to the Electronic Supply Chain Manual (ESCM) Volume 04 Section 08 Chapter 01 should any discrepancy be identified with the delivery.

Returned Explosive Ordnance

1.20 All EO returned from user units, sealed with a Defence transit seal in accordance with Regulation 2.3 Procedure 3, is to be given an inspection to ensure that it is suitable for storage and subsequent reissue. The inspection sample size will depend upon Service/Defence Science and Technology Group (DSTG) standard practices. Regulation 1.5 promulgates guidance on the type of inspection required.

1.21 All EO returned from user units sealed with a Defence logistics seal in accordance with Regulation 2.3 Procedure 3, EO Depot seal or manufacturers factory seal, should be considered to be in the condition sentenced by the authorised inspector, as indicated on the package. For example, if the item of EO has been sentenced as serviceable, the item of EO should be accepted as a serviceable item which can be immediately reissued, with no further remediation required to be conducted on the item, should the Service need arise.

Forms used for stock management

1.22 **Explosive ordnance stack record form.** The explosive ordnance stack record, Form GI 051 may be used for the management of stock held in storage facilities including open sites Further information on Form GI 051 is found at Annex A.

1.23 **Suspension card (Form AE 468).** When EO suspected of being unreliable or in a condition that is other than serviceable, it must be withdrawn from use. An EO Safety Message (EOSM) (see Regulation 1.5 Procedure 3) will be issued from the EO Management Agency informing the user of the degraded condition. Suspension cards (Form AE 468) is then required to be placed upon any stacks of the affected item. Suspension cards are designed to highlight to the user that the item of EO cannot be issued for any purpose other than as directed by the EO Management Agency. Further information on suspension cards is available in Annex B.

1.24 **Restriction card (Form AE 467).** When EO which has a known defect or a hazard which may alter the EO's technical integrity, such as its performance no longer meets the required specification or a safety oriented condition that requires special treatment (prior to the item publication amendment) but is still considered safe for storage, transport and is permitted for limited use, it is to be reclassified from a 'serviceable' condition. An EOSM will be issued from the EO Management Agency informing the user of the degraded condition. A restriction card (Form AE 467) is then required to be placed on the stack to highlight to users that a restriction affects the item. Further information on restriction cards is available in Annex C.

Annexes:
A. Explosive Ordnance Stack Record (Form GI-051)
B. Suspension Cards (Form AE 468)
C. Restriction Cards (Form AE 467)

ANNEX A

EXPLOSIVE ORDNANCE STACK RECORD (FORM GI-051)

Introduction

1. The Explosive Ordnance Stack Record - Form GI-051[1] may be used for the management of stock held in storehouses or at open sites as it provides the users means of quickly identifying stack information such as type of store, lot, and quantity.

Purpose

2. This procedure prescribes the requirements for, and the use of, Explosive Ordnance (EO) Stack Records (Form GI-051).

Explosive Ordnance Stack Record (Form GI-051)

3. Stack Records may be used in all storage facilities. See Figure 1A-1 for a sample of an Explosive Ordnance Stack Record.

4. The Stack Record is to be displayed on individual stacks of EO and records the:

a. building number and stock location;

b. contents of the stack by condition, stock number, short item name and lot or serial number details;

c. history of transactions involving items to the stack; and

d. balance of stock within the stack at any given time.

5. Stack Records are to be raised when a new stack is created. Procedures relating to the stacking of EO are given in Regulation 4.1 Procedure 8.

6. Where a stack unavoidably contains mixed lots, (see Regulation 4.1 Procedure 1, paragraph 1.6) the 'Lot Details' box on the form is to be annotated 'Mixed Lots' and the 'Stock Balance' box is to reflect the total stock quantity for the stack.

7. When items in a stack are controlled by serial number the 'Lot Details' box is to be annotated 'Serial No Controlled' and the serial numbers entered in the remarks column against each transaction.

8. When EO is stored in the open, Stack Records are also to be raised but they are to be held at the Explosives Area Control or Site Office and filed in stock number order.

9. The NATO Stock Number (NSN) used to order Form GI-051 is 7530-66-138-6407.

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[1] Commercial EO Services Providers may substitute an equivalent internal form.

ANNEX A

GI 051
Revised Feb 2007

Department of Defence

Explosive Ordnance Stock Record

Building number	Stock location	Condition

Stock number	Lot details

Short item name

Date of transaction	Transaction serial number *(TSN)*	Receipts	Issues	Stock balance	Remarks

Stock No 7530-66-138-6407

Figure 1A-1 – Sample of Explosive Ordnance Stack Record (Form GI – 051)

ANNEX B

SUSPENSION CARDS (FORM AE 468)

Introduction

1. When Explosive Ordnance (EO) fails to perform to specification or is suspected of being unreliable, or of a degraded condition but is not considered unsafe for storage and transport, it must be withdrawn from use. Indications of a change in the condition of the EO may result from defect reporting action, proof test results, manufacturers' reports or from advice from other Australian and overseas Defence users. Suspension cards are designed to highlight to the user that the item of EO cannot be issued for any purpose other than as directed by the Explosive Materiel Branch (EMB).

Purpose

2. This procedure prescribes Suspension Card procedure for EO found to be of suspect performance or degraded condition but is not considered unsafe for storage or transport.

General

3. Suspension Carding is a procedure for clearly marking EO whose condition or reliability is suspect, confirmed as other than serviceable but is not unsafe for storage and transport.

4. The Suspension Card is a visual indicator that clearly identifies the EO from other items so as to prevent the issue or use of such EO, pending the completion of investigations or other required action. Such EO is to be segregated or isolated from other stock. At all times Suspension Cards override all other condition status indicators on packages. Suspension Cards are divided into the following two types:

a. **Suspension Card - General.** Has Service/Defence wide application and is used when specific lots of EO are suspected of being other than serviceable or unsafe. Notification of a Suspension - General will be via an Explosive Ordnance Safety Message-Suspension (EOSM-S). See Regulation 1.5 Procedure 3 for further information regarding types of EOSMs.

b. **Suspension Card - Local.** Is applied to individual items or small quantities of a complete lot by the stockholder or user, when it is suspected that the stock is unfit for issue or use. It is to be applied in conjunction with defect reporting action in accordance with Regulation 1.3 Procedure 1. Additionally the local suspension could be initiated as a means of tracking a modification programme or other than routine maintenance that is in progress.

NOTE

Form AE 468 is used for both General and Local Suspensions. The user is to strikethrough the incorrect application at the top of the form thus indicating to other personnel what type of suspension action the affected stock is under.

Registers for Suspension Carded Explosive Ordnance.

5. The EMB is to hold a master register for EOSM-S which is accessed on the EOSM Webpage. A register for Suspension Card - Local is to be held at the unit.

Suspension Card Procedures

6. When EO is suspended, EO Depots, JLU REOS and Units will be informed by an EOSM-S. The stockholder, custodian or user of the EO is responsible for the completion of Form AE 468.

7. The NATO Stock Number (NSN) used to order Form AE 468 is 7530-66-161-7051. An example of Form AE 468 is located below at Figure 1B-1.

ANNEX B

8. The completed Form AE 468 is to be placed on suspended stock. The identification particulars of the stock concerned are to be recorded on the form, along with whether it is a General or Local restriction (strike out the incorrect application), the reason for the restriction (in the remarks column) and authority for suspending i.e. EOSM-S Serial Number if applicable.

9. Suspension Cards are to be placed on the stocks immediately when the EOSM-S is received or when Local Red Card action is found necessary. The cards are to remain in position until the suspension is removed or the stores in question are disposed of. Similar action is to be taken in respect of suspended items packed with the parent store. The parent store is also to be suspended until the suspension is lifted or the affected items replaced. Demands for essential replacement stores are to be made in accordance with Electronic Supply Chain Manual (ESCM) Volume 4 Section 08 Chapter 1 Annex B.

Specific Suspension– General Procedures

10. On receipt of an EOSM-S, EO Depots, REOS Personnel and Units are to complete the following actions, as appropriate:

a. Immediately segregate or isolate the stock concerned, if necessary.

b. Complete Form AE 468 and place the form on the stock affected. The remarks section of Form AE 468 may be completed by attaching a typed copy of the remarks i.e. Computer Support for Armaments (COMSARM) screen CM03 printout.

c. Comply immediately with instructions the suspending authority has issued.

d. Adjust stock records and take the required stores accounting action in accordance with ESCM Volume 4 Section 08 Chapter 1 Annex I;

e. Demand replacement stores in accordance with ESCM Volume 4 Section 8 Chapter 1 Annex B.

f. Deal with stores in transit when the EOSM-S is received.

Method for Removing Suspension – General

11. The restrictions imposed by Suspension – General are to be cancelled under the following conditions only:

a. The issue of a signal that cancels the previous EOSM-S – General action

or

b. Disposal action has been taken on the stocks concerned.

Emergency Use of Suspension – General Explosive Ordnance

12. EO which is the subject of a Suspension – General is not normally to be used since the nature of defect has not been determined. Where operational necessity warrants the use of such EO, its use is to be authorised by CJLOG. This dispensation is to be arranged by EMB. When approval is granted the EMB is to be advised by priority message. This message is to state the conditions governing the use of the items. The authority and conditions of use are to be issued as an annotation to the relevant EOSM-S.

Duration of Suspension – General Actions

13. Suspensions are not normally to remain in force for more than 6 months. The EMB is responsible for ensuring that the preparation of any repair, maintenance or other instructions for upgrading suspended stock which can be recovered is expedited. A review of EOSM-S are to be undertaken by the EMB every 6 months and revised recommendations are to be promulgated.

14. The EMB is to establish procedures for controlling the timely upgrade of suspended stocks capable of recovery.

Specific Suspension – Local Procedures

15. Suspension - Local procedures are to be used when:

a. The user is doubtful whether the EO is fit for issue or use, pending the completion of local investigations by EO Depots and/or REOS personnel.

b. At user establishments, following reports of defective performance and pending receipt instructions from the EMB.

c. EO awaiting receipt inspection.

d. EO held in quarantine account as a result of a defect report or not covered by sub-paragraph c.

e. On EO recovered from an accident.

f. On EO which was involved in trials.

g. On experimental EO: the Form AE 468 is to be endorsed ‘Only to be issued or used on the authority of …………….. (Appointment concerned)’.

h. EO which has not been correctly sealed.

16. **Action by Users.** When the user is doubtful whether EO is fit for issue or following defective performance, the EMB is to be notified by Explosive Incident Report Form EO 016 in accordance with Regulation 1.3 Procedure 1.

17. Where the EMB considers that the Suspension – Local action is applicable to a wider area, action may be extended to other establishments, Suspension – General procedures are to be issued. Suspension – Local are to be cancelled by the stockholder when the need for raising them has passed or as instructed by an EOSM-S.

18. EO, recovered after an accident or returned from a trial, may be submitted for special inspection conducted by an authorised EO Inspector unless it is obviously beyond repair, or in a dangerous state. In this case immediate disposal is to be requested.

19. In the circumstances described in paragraph 15 g, it is unnecessary to notify the EMB.

20. **Action by EMB.** The EMB is to investigate reports of defective items that are received and when necessary, suspend the affected item. EO Depots, REOS personnel and Units are to be informed of the suspension by EOSM-S. Alternatively, when the EMB investigation does not confirm the reason for the local suspension, the local action is to be cancelled. In this case the EMB is to provide direction to the originator.

Issue of Suspension – Local EO

21. In the following circumstances, the EMB may authorise the continued use of EO which is under Suspension – Local action when:

a. The reported defect is known and there is no danger in using the EO, and the performance is acceptable for the purpose required

or

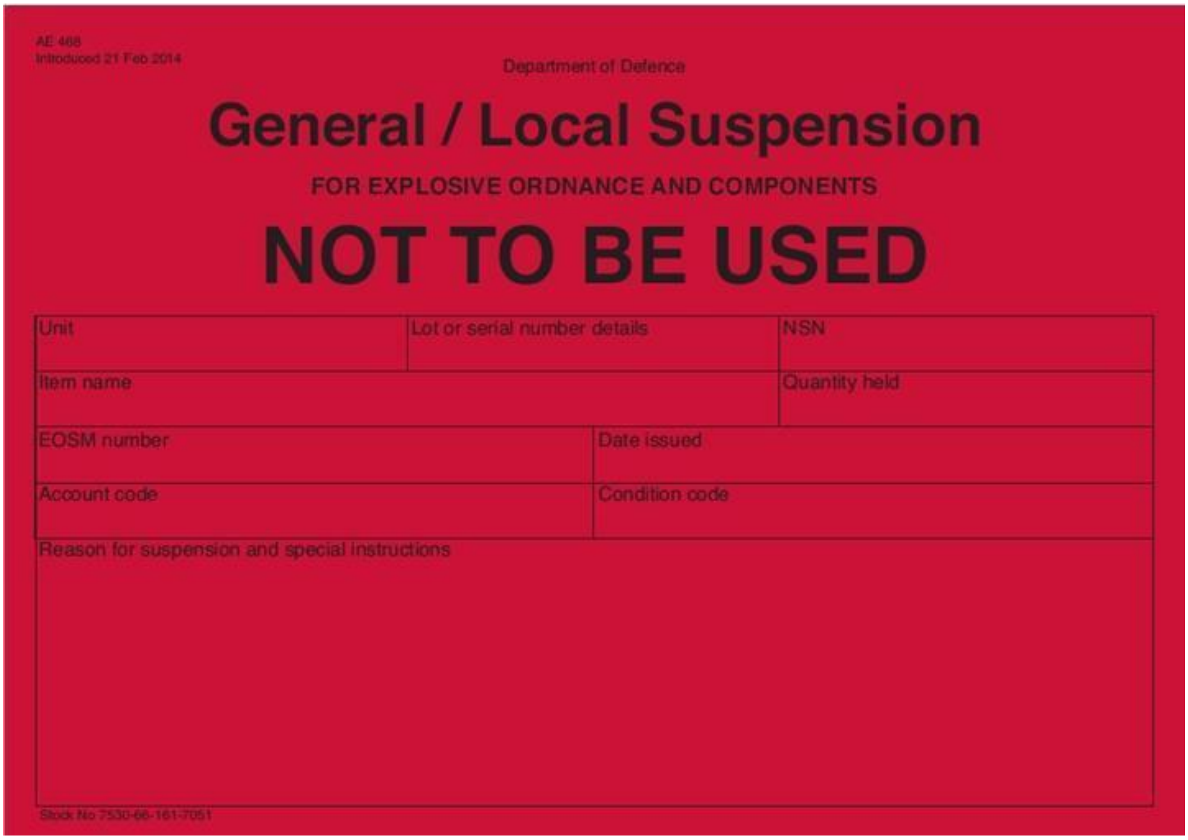
b. The EO is safe for use and replacement stocks are not available.

ANNEX B

Reporting and Investigating of Outstanding Suspended Explosive Ordnance

22. EO Depots and Users are to report details of suspended EO (including Suspension – Local actions) which have been under Suspension action for a period exceeding 6 months, to the EMB at the end of February and October each year. This report is to include the reasons for the stock remaining under Suspension action and not having been upgraded or disposed of, as appropriate.

23. The EMB is to investigate the reasons for outstanding suspended stocks and, when appropriate, is to hasten or implement action for removal of the suspension.



AE 468
Introduced 21 Feb 2014

Department of Defence

General / Local Suspension

FOR EXPLOSIVE ORDNANCE AND COMPONENTS

NOT TO BE USED

Unit	Lot or serial number details	NSN
Item name		Quantity held
EOSM number	Date issued	
Account code	Condition code	
Reason for suspension and special instructions		

Stock No 7530-66-161-7051

ANNEX B

INSTRUCTIONS FOR USE

1. Procedure for Suspension cards is promulgated in the eDEOP 101, Regulation 4.8, Procedure 1, Annex C.

2. At all times Suspensions over-ride all other condition status indicators on packages.

3. Reasons for stock being suspended are detailed in the related Explosive Ordnance Safety Message (EOSM).

4. The Suspension card is to be fixed to all stocks of the identified explosive article.

5. Users are to strike out either General or Local depending on the origin of the suspension.

6. The suspension may only be removed or cancelled under the following conditions:

   a. Removal of the restriction by a cancelling EOSM issue from the EO Management Agency.
   b. When stocks have been sentenced 'Fully serviceable' by an Inspector of Explosives.
   c. When stocks have been disposed of.

Figure 1B-1 – Form AE 468 Suspension Card – Front and Back Views

ANNEX C

RESTRICTION CARDS (FORM AE 467)

Introduction

1. When Explosive Ordnance (EO) which has a known defect or hazard which may alter the EOs technical integrity, such as its performance no longer meets the required specification or may have a safety oriented condition that requires special treatment (prior to the item publication amendment) but is still considered safe for storage, transport and is permitted for limited use, it is to be reclassified from a 'serviceable' condition. A Restriction Card is then required to be placed on the stack to highlight to users that a restriction affects the stock.

Purpose

2. This procedure prescribes Restriction Card procedure for EO which has a known defect or has a safety oriented condition but is still considered safe for storage, transport and is permitted for limited use.

General

3. EO which has a known defect or has a safety oriented condition that requires special treatment (prior to the item publication amendment) and which has restricted use may, in certain circumstances, continue to be issued to the Service for use in restricted capacity. These restrictions will apply to either:

a. Total stocks of an explosive store

or

b. Certain lot or batch numbers of an explosive store.

Restriction Card Procedures

4. When an item of EO is restricted in its use, EO Depots, Regional Explosive Ordnance Services (REOS) personnel and Units will be informed via an EOSM-Restriction issued by the Explosive Materiel Branch (EMB) within the Capability, Acquisition and Sustainment Group (CASG). The EOSM-Restriction will detail the item of EO, type of restriction and instructions to be implemented.

5. See Regulation 1.5 Procedure 3 for additional detail on EOSMs.

6. The NSN used to order the Restriction Card (Form AE 467) is 7530-66-161-7050. An example of Form AE 467 is located below at Figure 1C-1. The Restriction card is used as a visual indicator that the stock has a restriction applied to it. The EO Depots or Users of the EO are responsible for the completion and placement of the Restriction Cards.

7. The completed Form AE 467 is to be placed on the restricted stock pending its re- referencing or use.

Action by EO Depots, REOS and Units.

8. On receipt of an EOSM-Restriction, EO Depots, REOS and Units are to complete the following actions, as appropriate:

a. Complete Form AE 467 and place the form on the stock affected. The remarks section of Form AE 467 may be completed by attaching a typed copy of the remarks i.e. Computer Support for Armaments (COMSARM) screen CM03 printout.

b. Comply immediately with instructions the restricting authority has issued.

ANNEX C

c. Adjust stock records and take the required stores accounting action in accordance with Electronic Supply Chain Manual (ESCM) Volume 4 Section 08 Chapter 1 Annex I.

d. Demand replacement stores in accordance with ESCM Volume 4 Section 8 Chapter 1 Annex B.

e. Deal with stores in transit when the EOSM-Restriction is received.

9. When affected stores are available for issue from an EO Depot, users are to be asked is such stores are acceptable and if so, such stores are to be issued in preference to other stock. Issue vouchers are to be suitably annotated that the store has restrictions that are to be adhered to.

Duration of Restriction Actions

10. EOSM applying a restriction to an item of EO will only be cancelled by the issue of a cancelling signal when the restriction is no longer applicable. Alternatively, the restriction no longer applies when the stores service life expires or they are consumed.

AE 467
Introduced 21 Feb 2014

Department of Defence

RESTRICTION

FOR EXPLOSIVE ORDNANCE AND COMPONENTS

Unit	Lot or serial number details	NSN
Item name		Quantity held
EOSM number	Date issued	New expiry date
Account code	Condition code	

Details of restriction

Stock No 7530-66-161-7050

ANNEX C

INSTRUCTIONS FOR USE

1. Procedure for Restriction card action is promulgated in the eDEOP 101, Regulation 4.8, Procedure 1, Annex D.

2. Stock identified under a Restriction has a known defect but is safe to use in a limited role. See the associated Explosive Ordnance Safety Message (EOSM) issued by the EO Management Agency for further guidance on the restriction.

3. The Restriction cards are to be fixed to all stocks of the identified explosive article.

4. The restrictions may only be removed or cancelled under the following conditions:

   a. Removal of the restrictions by a higher authority.
   b. When the explosive articles service life expires.
   c. When stocks have been consumed.

5. The Restriction card is to be completed with as much information as possible. Any fields that are not applicable to this particular restriction, such as 'New expiry date' (for the item of EO), are to annotate N/A.

Figure 1C-1 – Form AE 467 Restriction Card – Front and Back Views

REGULATION 5.1 - SITING FOR EXPLOSIVES FACILITIES

General Overview

1.1 Facilities containing Explosive Ordnance (EO) present a risk of fire or explosion, which may cause injury to persons or damage to property and facilities both within and outside the EO area, or may cause the destruction of other EO within the area.

Requirements

1.2 The siting of EO facilities is to be undertaken;

a. when developing a new EO facilities planned for construction; and

b. where an existing facility is being significantly altered or redesigned.

1.3 Boards of Officers will be convened for facilities consistent with paragraph 1.2 except for small quantity facilities such as;

a. ready-use EO storage lockers;

b. cupboards;

c. compartments; and

d. annexes.

1.4 When siting EO facilities consideration must be given to;

a. storage and handling capacity;

b. accessibility;

c. isolation;

d. terrain and climate;

e. road and rail communications;

f. public utilities;

g. local major installations and community assets;

h. use of public facilities;

i. consultation with experts; and

j. future development.

Responsibilities

1.5 Boards of Officers will be convened and to make recommendations on;

a. the selection of suitable sites for the construction of new facilities, or alterations to existing facilities;

b. the hand over of the facility from the construction authority; and

c. the authorisation of EO facilities.

Procedures

1.6 Procedures related to the siting of EO facilities are;

a. Procedure 1 - Explosive Ordnance Facility Board of Officers Procedures;

b. Procedure 2 - Planning, Siting and Construction of an Above-ground Explosive Ordnance Depot; and

c. Procedure 3 - Siting of Explosive Ordnance Areas and User Establishments.

PROCEDURE 1 - EXPLOSIVE ORDNANCE FACILITY BOARDS OF OFFICERS PROCEDURES

Introduction

1.1 When new Explosive Ordnance (EO) facilities are planned for construction, when significant alterations to existing EO facilities are necessary, or when non-explosives facilities which are likely to affect the storage or handling capacity of any EO facility are to be sited, a Board of Officers is to be convened to consider independently all matters relating to the siting and acceptance of those facilities, and authorisation, if they are EO facilities.

1.2 The Board of Officers' procedure enable professional on-the-spot assessment of local conditions and the requirements of Defence explosives instructions. It ensures that all concerned take an active part in deliberations concerning siting, acceptance and authorisation of the facilities in question.

1.3 Boards of Officers will be required to act in two capacities as described below:

a. **Site Selection Board.** A Site Selection Board (SSB) is a Board of Officers convened to make recommendations on the selection of sites, construction of new facilities or alterations to existing facilities.

b. **Facilities Acceptance Board.** A Facilities Acceptance Board (FAB) is a Board of Officers convened to take over new EO facilities or altered facilities from the construction authority and to make recommendations on the authorisation of such facilities.

1.4 Small Quantity Facilities, such as ready-use EO storage lockers, cupboards, compartments, annexes etc do not warrant a formal SSB, and may be sited by a less formal process (see Regulation 5.3 for details). Security requirements are to be determined by a detailed security survey in accordance with the Defence Security Manual. Advice must be sought from the Licensing Authority when such a facility is planned.

Purpose

1.5 This procedure is to be applied when:

a. New EO storage, loading, preparation, inspection or maintenance facilities (including vehicle/vessel/aircraft parking/mooring/loading areas) are to be sited;

b. Alterations to existing EO facilities are to be made;

c. Non-explosives facilities which might affect the capacity of existing EO facilities are to be sited; and

d. New or modified EO facilities are to be accepted by Defence from the construction authority.

Determination of Requirements

1.6 Requirements for new EO facilities or major alterations to existing facilities may be initiated by establishments, Commands or the Estate and Infrastructure Group (E&IG). In all instances it is essential that the Directorate Logistics - Explosive Ordnance (DLOG-EO) and the Licensing Authority for the facilities concerned are involved in the earliest planning stages to ensure that the facility will be able to be licensed for the necessary type and amount of EO when completed. Additionally, where initial planning is undertaken by establishments and regional E&IG offices, E&IG also needs to be engaged at a strategic level (early in the process) to ensure that the wider Defence issues of master planning and safeguarding are properly considered.

Site Selection Boards (SSB)

1.7 Instructions for convening SSBs for EO facilities and non-explosive facilities that might affect existing EO facilities are contained in the Defence Estate Managers Guide (DEMG).

1.8 Responsibilities of the DEOG Representative(s) on a SSB. The DEOG and Licensing Authority representatives are to be conversant with the requirements of this Manual and the EO facilities at the establishment under consideration. The following aspects will need to be addressed by the representatives to ensure that the SSB outcomes adequately meet DEOS requirements:

a. The number, type of construction and use of EO facilities or alterations required to a facility to meet specific needs, as governed by these instructions;

b. The maximum quantity of EO, by Hazard Division, for each facility, together with the explosives compatibility groups recommended for each facility;

c. The siting and protection of non-explosives facilities, if applicable;

d. The requirement for traverses, or special building construction to obviate the need for traverses;

e. Safeguarding and zone planning requirements ie the Outside and Inside Quantity Distances which are available. When required quantity distances are not available this aspect is to receive special mention; and

f. Details of alternate storage schemes, sites or other suggestions which the Board considers to be practicable.

1.9 Preparation of Facilities Layout Plans. The DEOG representatives are to ensure that the findings of the Board include the following:

a. A scaled safeguarding map showing the whole of the outside danger area and the facilities which control the Outside Quantity Distances.

b. A zone planning map showing the area reserved for EO facilities only and their applicable quantity distances.

c. Plans of the buildings, or alterations required, or references to standard plans where applicable.

Facilities Acceptance Boards

1.10 The composition, responsibilities, procedures and occasions for the convening of a FAB are detailed in the DEMG.

1.11 Findings and Recommendations of an Acceptance Board. At the conclusion of on-site investigations of the EO facility under consideration, the Board is to record its findings and recommendations. A copy of the findings is to be provided to DEOG and the recommendations must include:

a. Any departure from the plans or specifications which should be investigated and, if necessary, rectified;

b. A draft Explosives Limit Licence for the facility, prepared by the Licensing Authority. The Board is to state the reasons for, and the implications of work to overcome, any recommended deviations; and

c. Any changes in the available quantity distances which should be investigated and rectified.

1.12 Processing of Board's Report. The report of the proceedings, findings and recommendations of the Board is to be processed as specified in the DEMG.

Review of DEMG Instructions

1.13 Due to the co-dependence of this instruction and the instructions detailed in the DEMG, the Licensing Authority is to undertake an annual review of the DEMG to ensure conformity of requirements.

Annex:
A. References Applicable to Boards of Officers

ANNEX A

REFERENCES APPLICABLE TO BOARDS OF OFFICERS

Procedures from this manual and other references listed in the table below contain information essential to the activities of Boards of Officers:

Policy/Regulation	Reference
Planning, Siting and Construction of an Aboveground Explosive Ordnance Depot	Regulation 5.1 Procedure 2
Siting of Explosive Ordnance Storage Areas at User Establishments	Regulation 5.1 Procedure 3
Calculation of Storage Capacity and Space Requirements	Regulation 6.1 Procedure 3
Principles for Design and Construction (of Explosive Ordnance Facilities)	Regulation 6.1 Procedure 1
Traverses (Design Considerations and Specification Requirements)	Regulation 6.1 Procedure 2
Licensing of Explosive Ordnance Facilities and Activities	Regulation 5.2 Procedure 1
Deviations from Mandatory Explosives Safety Requirements	Regulation 1.2
Safeguarding and Zone Planning (for Explosive Ordnance Facilities)	Regulation 5.6 Procedure 1
Quantity-Distance and Explosive Licensing Criteria for Aboveground Storage and Handling	Regulation 5.4
Safety Requirements for Electrical Installations and Equipment and Precautions against Electrical Hazards – Explosive Ordnance Areas and Facilities	Regulation 6.3 Procedure 1
Lightning Protection	Regulation 6.2 Procedure 1
Explosive Ordnance Workshops (Administration of)	Regulation 4.4 Procedure 5
Explosive Ordnance Preparation Facilities (Administration of)	Regulation 4.4 Procedure 7
Storage of Explosive Ordnance	Regulation 4.1 Procedure 1
Non-Explosive Dangerous Goods – Storage, Inspection and Transport	Regulation 4.4 Procedure 11
Infrastructure Management Website	(http://intranet.defence.gov.au/im/)

Table 1A–1: List of Applicable References to Boards of Officers

PROCEDURE 2 - PLANNING, SITING AND CONSTRUCTION

Introduction

2.1 When developing a new explosive ordnance depot, or replanning an existing area, careful and correct planning, siting and construction of the depot is essential to ensure safe, efficient and economic operation. There is also the need to provide the best possible storage and handling environment, to ensure that users are supplied with reliable Explosive Ordnance (EO) at the right time and place. The planning, siting and construction are to be such as to prevent or minimise injury or damage caused by the accidental or deliberate functioning of the stocks held.

Purpose

2.2 This instruction details the factors to be considered for the planning, siting and construction of an aboveground EO depot.

General Considerations

2.3 **Explosives Parameters.** Although it may be operationally accepted in certain cases that in the event of an explosion in one EO storehouse, the adjacent storehouse may be damaged or even destroyed and the contents of such buildings rendered other than serviceable, the observance of the Quantity Distance requirements, and of the construction of buildings requirements, will ensure that sympathetic explosions and chain reactions are avoided. Damage outside the EO area will also be kept to the minimum consistent with reasonably practical considerations.

2.4 **Future Expansion.** The need to plan for possible future expansion is a primary requirement.

2.5 **Selection of Site.** The sites for all types of EO depots are to be selected by a Board of Officers convened in accordance with Regulation 5.1 Procedure 1.

SITING

General

2.6 When siting an EO depot the factors which may affect its operation under all conditions are to be considered. Although it is unlikely that one area will be found which meets all requirements, the best combination of desirable features is to be achieved.

Considerations

2.7 Some of the more important factors to be considered when siting an EO depot are:

a. Storage and handling capacity.

b. Accessibility.

c. Isolation.

d. Terrain and climate.

e. Road and rail communication.

f. Public utilities.

g. Local major installations.

h. Use of public utilities.

i. Consultation with experts.

j. Future development.

Storage and Handling Capacity

2.8 The site selected is to be capable of accommodating a specified quantity of EO with a specified mix of Hazard Divisions and Compatibility Groups. The site should have also the facilities for handling the requirements of maximum operational effort.

Accessibility

2.9 Depending on the type of depot being sited, the locations selected are, as far as possible, to be accessible to the following:

a. the sources from which stocks are likely to be received, ie factories, ports and other EO depots;

b. the establishments and units which the depot is intended to supply;

c. navigable inland waterway which may provide suitable movement facilities;

d. ports and/or airfields from which shipments can be made; and

e. a civilian labour force if the depot is to be manned by civilians.

Isolation

2.10 Notwithstanding the requirements of paragraph 2.9, the site is to be sufficiently isolated to comply with the Outside Quantity Distances (OQD) prescribed in Regulation 5.4 Procedure 1 and these OQD are normally to be contained within the perimeter of Commonwealth property.

2.11 The right to prevent civil encroachment within the OQD is always to be secured where such quantity distances extend beyond the perimeter of Commonwealth property; where this is not possible the site should not to be selected as a permanent EO area.

2.12 To reduce the risk from aircraft or of aircraft force landing in EO areas, the sites selected should not be within an airfield circuit.

Terrain and Climate

2.13 Dry and temperate storage conditions are highly desirable. The land should therefore be well drained and as dry as climatic conditions permit. Terrain which is liable to flooding is to be avoided; local records may indicate whether such a liability exists. Areas in which the roads become blocked by water are to be avoided.

2.14 The subsoil should be firm and stable otherwise subsidence of traverses, roads and hard standings may result.

2.15 Thickly wooded sites are unsatisfactory owing to the excessive fire risk in dry weather and the consequent effort and expenditure necessary in cleaning undergrowth and firebreaks. Such sites are normally badly ventilated and excessively humid as well as making access for cranes and heavy vehicles difficult; on the other hand, there is an advantage of natural concealment to be considered.

2.16 Dry, gently undulating country provides natural traverses, assists concealment, and is in every way most suited to the storage of EO, but it usually involves a large area making transportation and security difficult to organise and administer.

2.17 Depots should not be sited in areas subject to excessive electrical storms or other atmospheric abnormalities.

Road and Rail Communications

2.18 The area selected should be served by good roads of sufficient width and strength to permit their use by a constant flow of heavy traffic.

2.19 Access roads should not pass through congested towns and the danger and inconvenience resulting from a possible accident to a vehicle carrying EO or toxic materials should be borne in mind.

2.20 Unless a railway system exists, or can be constructed to enter the EO area, good road communication with the nearest railhead will be required.

2.21 **Alternative Access.** Whenever possible main road and rail routes to and from the depot should be duplicated and widely separated.

Public Utilities

2.22 The depot is not to be sited over or under, or threaten public utilities.

Local Major Installations and Community Assets

2.23 Due account must be taken of radio and radar transmitters, electricity supply installations, fuel and other hazardous facilities, civil and military airfields, and culturally important or significant community assets.

Use of Public Facilities

2.24 It is important to ensure that existing public facilities are capable of accepting any increased volume and weight of traffic that may be imposed by the depot and that adequate connections can be provided to and from the depot.

Consultation with Experts

2.25 Continuous consultation with specialist advisers and local authorities is necessary to ensure that their particular requirements are being met and to ensure that any new requirements are incorporated into the design at a time when changes can be accepted.

Future Development

2.26 The selected site should be capable of easy development beyond the immediate requirements.

LAYOUT

Areas to be Included

2.27 A depot should consist of these distinct areas:

a. an EO area containing buildings and areas for the storage, handling, surveillance and processing of EO, as well as associated non-explosives buildings;

b. a demolition and/or burning ground for disposal of EO;

c. an administrative and general non-explosives workshop area providing all the facilities to support the EO area and depot personnel; and

d. if adjacent to a waterway - an EO wharf.

Explosive Ordnance Area Buildings and Other Facilities

2.28 Magazines and EO Storehouses. Magazines and EO storehouses are to be sited to meet the known storage requirement.

2.29 Inspection and Maintenance Buildings. Inspection and maintenance buildings are to be positioned in the EO area, paying due regard to quantity distances, so that the greatest convenience is achieved in handling the stores being inspected and maintained.

2.30 Miscellaneous Buildings. In addition to the storage and processing facilities the EO area may contain buildings or areas for the following functions:

a. Inert ammunition, components and packages.

b. Canteens, ablutions and change rooms for use by personnel working in the EO area.

c. Garages and charging facilities for Materials Handling Equipment used in the EO area.

2.31 Roads. Roads within an EO area should serve all stacks and buildings and should generally be planned on a one-way system. They are to be of sufficient width and strength to permit the use of the largest and heaviest vehicles likely to be used. No gradient is to exceed 1:20 and where trolleys without brakes are in use, eg alongside buildings, the gradient is not to exceed 1:100. The minimum inside radius at corners is to be determined on the basis of the transport concept of operations. Provision is to be made for truck holding areas.

2.32 Lighting. Street lighting to the standard required in built up areas should be considered for reasons of safety and security (see also Regulation 6.3).

Demolition and Burning Grounds

2.33 Wherever possible the site for an EO depot is to include space for demolition and/or burning ground(s) to enable non-repairable or dangerous EO to be destroyed on the spot. The demolition/burning ground(s) should be remote from the EO area to ensure complete safety, but is to be accessible.

Administrative Area

2.34 The administrative area should be sited outside the Inhabited Building Distance from the EO area but as close to the perimeter as quantity distances permit in order to facilitate control. The administrative area may contain:

a. Main Offices, non-explosives workshops and garages.

b. Medical, fire and other emergency services including telephone exchange.

Explosive Ordnance Wharf

2.35 The EO wharf is to be capable of handling the maximum amount of traffic required for operational efficiency. Adequate moorings are to be provided both alongside and in the stream. Fresh water, electricity and telephone connections are to be provided for ships and permanent lighting should be installed to allow work after dark. Adequate firefighting facilities are to be installed and should include remote control start pumps to enable firefighting to be supplemented with a supply of salt water.

Control of Access to Explosive Ordnance Area

2.36 The preferred method for controlling access to the EO area is by physical separation of the EO area from the rest of the establishment by fencing, with a control point at the entrance to the EO area. Such an arrangement has the added advantage of facilitating effective zoning of future EO and non-explosives facilities whilst at the same time restricting the application of the numerous safety precautions and requirements to the EO area only.

Criteria

2.37 The construction criteria of EO storehouses and process areas are described in Regulation 6.1. Although it is not practicable to construct surface buildings to withstand direct hostile attack their orientation may help to reduce hazards.

Economy

2.38 The construction of buildings for one hazard division only is uneconomic.

Non-Explosives Buildings Within Explosive Ordnance Areas

2.39 Non-explosives buildings sited within an EO area are usually of robust construction without large glazed areas. The design of such non-explosives buildings is to be such as to minimise the risk to occupants as far as is reasonably possible eg by planning the layout of the buildings so that washrooms, tool storage areas, etc are on the side of the building nearest to the Potential Explosion Site (PES). Due account must be taken however of the added debris risk to nearby light clad EO storehouses from possible demolition of a brick/concrete built office etc.

PROCEDURE 3 - SITING OF AREAS AND ESTABLISHMENTS

Purpose

3.1 This procedure details the requirements to be considered when selecting suitable sites for Explosive Ordnance (EO) areas at User Establishments.

General Considerations

3.2 This procedure is to be read in conjunction with Procedure 1 and Procedure 2, and while the general principles for the selection of sites for EO depots are applicable, the requirements of the following paragraphs are also to be observed.

3.3 **Selection of Site.** The site for an EO area at a User Establishment is to be selected by a Board of Officers in accordance with Procedure 1.

Details of Siting

3.4 **Operational Aspects.** Operational considerations are of utmost importance. The site is to be convenient to those points where prepared EO will be required, eg Explosive Ordnance Loading Aprons on air bases.

3.5 **Isolation.** The site is to be one which can be easily guarded and protected, but is also to be sufficiently clear of other essential buildings on the establishments that if an explosion occurs, the establishments will still be able to function.

3.6 **Future Expansion.** Consideration should be given to the possible extension of the area in the event of a change in the establishment's role.

3.7 **Zone Planning.** The establishment Master Plan is to be consulted to ensure that the capacity of the site will not be adversely affected by any other development for the establishment (see Regulation 5.6 Procedure 1 paragraphs 1.26 and 1.27).

3.8 Safeguarding. Safeguarding maps are to be prepared for the site in accordance with Regulation 5.6 Procedure 1, to assist in determining the area of land required for the site.

REGULATION 5.2 - LICENSING

General Overview

2.1 These regulations generally do not prescribe measures which guarantee immunity from the effects of an accidental explosion; instead the risks inherent in them are a compromise between absolute safety and the practicalities of cost and efficiency. Consequently, any lessening of the prescribed standards may compromise the safety of personnel or the level of damage expected at an Exposed Site (ES). Regulation 5.4 provides advice on what structures and facilities are suitable at various quantity distances, and also on the damage and injuries to be expected.

2.2 The regulations provide for alternative levels of protection against propagation of explosion between potential explosion sites and exposed sites.

Requirements

2.3 Licensing of Explosive Ordnance Facilities is to be conducted in accordance with this regulation and its associated procedures.

2.4 **Appointment of Licensing Authorities.** Licensing Authorities (LA) are to be appointed to fulfil the licensing requirements of these Regulations.

2.5 **Licensing of EO Facilities and Activities.** All static Explosive Ordnance (EO) storage and other facilities in the Australian mainland, except as formally agreed between licensing authorities and the Explosive Ordnance Safety Regulator (EOSR) must be licensed for that purpose by appropriately qualified personnel before EO can be introduced into those facilities.

Other Explosive Ordnance Activities requiring Authorisation

2.6 In addition to static EO facilities in the Australian mainland, there are other EO activities that are not permitted without the appropriate authorisation:

a. **Demolition and Burning Grounds.** Demolition and burning grounds are to be licensed in accordance with the provisions outlined in Regulation 5.5 and Regulation 4.4 Procedure 11.

b. **Overseas Facilities.** Activities by Australian Defence Force (ADF) units permanently deployed overseas are to be licensed in accordance with the host nation's standards, except when those standards are less stringent than the standards prescribed in this manual, in which case the Australian standards are to be used. Government to government agreements might override this statement but where host nation or ADF activities create a hazard to Australian personnel or property greater than the permissible hazard within Australia as detailed in this manual, the Minister for Defence is to be advised through normal departmental channels. Where ADF activities cannot comply with host nation standards, host nation approval is to be sought.

c. **ADF Operational Areas.** The storage of EO in a declared ADF area of operations is to be in accordance with this manual.

d. **Field Storage.** When authorised by DCJOPS field storage procedures described in Regulation 5.4 Annex H may be used provided non-departmental personnel and property are not exposed to a level of hazard greater than that implied in the principles applicable for permanent storage installations. The provisions for field storage are not to be used to alleviate storage deficiencies in permanent facilities.

e. **High Risk Situations.** In some situations, for example high risk testing, more stringent measures than those normally recommended may need to be applied. Authorities involved in these situations are to seek advice from their licensing authority who, as necessary, may seek further advice, through appropriate departmental channels, from the ESTC.

f. **Visiting Forces.** The storage and handling of EO, including licensing of EO facilities, by the ADF on behalf of visiting forces, is to be in accordance with the guidelines contained in this manual. Visiting forces maintaining their own logistics activities under a Status of Forces Agreement (SOFA) are to comply with Australian law. Where visiting forces are acting or training independently and no individual Service unit has responsibility for logistic or safety aspects, Commander Joint Logistics (CJLOG) will appoint, through the appropriate Service chief, a Service unit, with appropriately qualified technical liaison officers, to provide technical and logistic liaison to promote compliance with this safety policy, consistent with the terms of the SOFA. The host Service is to ensure that the contents of this manual are brought to the attention of the visiting force and their voluntary compliance sought. Instances of non-compliance are to be advised to the visiting force by the host Service. If compliance is not forthcoming, direction must be sought from CJLOG.

2.7 **Leasing/Renting Facilities.** All EO related activities conducted in leased, rented or borrowed facilities are to be in accordance with relevant Commonwealth, State or Territory legislation, except where such legislation imposes standards which are less stringent than the standards prescribed in this manual, in which case this manual is to apply. Unless otherwise approved by the Minister for Defence, EO related activities are not to be conducted at leased, rented or borrowed facilities if such activities create a hazard to personnel or property greater than the hazard level detailed in this manual. Similarly, if EO related activities of other tenants or occupants create a hazard greater than the hazard level detailed in this manual, Defence activities are to cease unless otherwise authorised by the Minister for Defence.

2.8 **Deviation from the Regulations.** Any activity which requires a deviation from these regulations and which results in an increase in the risk of death, injury or property damage must be approved by an Executive Authority (*see* Regulation 1.2) before a licence or other appropriate authority is issued.

2.9 **Permissible Hazard Level.** Licensing authorities must issue licences only where, in their judgment, the associated hazard to people or property is no greater than the permissible hazard level inherent in these regulations, unless an Executive Authority approves a deviation from this requirement (*see* Regulation 1.2).

2.10 Because these regulations do not provide for every conceivable situation, the licensing authorities are to seek guidance from the Explosives Storage and Transport Committee (ESTC) where the regulations require interpretation.

2.11 Licensing and monitoring authorities are to seek guidance from the service chiefs of levels of protection required with respect to stock management issues such as strategic significance of stock held, replacement lead times and cost. These various levels of protection are to be applied when determining storage quantities.

2.12 **Content of Licences.** Licences are to provide details of:

a. Licence number;

b. Facility and building number;

c. Building use (if appropriate), eg storage, laboratory, workshop, etc;

d. Net Explosives Quantity (NEQ) by kg and by hazard division;

e. Building personnel limits if considered appropriate by the licensing authority;

f. Limitations imposed by the licensing authority;

g. ES which limit the licensed NEQ (where necessary);

h. Other factors which limit the licence;

i. The date the licence was issued; and

j. Name, appointment and telephone number of the licensing authority.

2.13 The current approved licence/s is to be held by the officer-in-charge of the facility with the master copy being held by the licensing authority. They are available from the Directorate of Logistics - Explosive Ordnance Branch (DLOG-EOB) EO Licensing Authority website. Advice that a new licence is available will be sent to stakeholders via a formatted email.

2.14 A copy, or abstract, of the licence, or a subordinate authorisation containing the data specified in paragraph 2.12 must be displayed in a prominent position.

2.15 As a function of the EO safety monitoring process described in Regulation 1.4 Procedure 01, progressive independent review of licences is to be conducted by each monitoring authority for all facilities which they audit.

2.16 **Explosive Limit Licence Register.** Licensing authorities are to maintain a master register of all explosive limit licences extant for their Group(s). These registers are to be made available to monitoring and auditing authorities on request.

Responsibilities

2.17 The Chief Defence Scientist (CDS) is to appoint a licensing authority for the Defence Science and Technology Organisation.

2.18 The LA responsible for the remaining Defence Groups is the Deputy Director EO Licensing Authority (DDEOLA) in DLOG-EOB. Contact details for the LA are available from the EO Licensing Authority web site

2.19 Deputy Chief Joint Operations (DCJOPS) will normally approve licences for operations and major exercises.

2.20 LAs are responsible for issuing licences for each discrete site within their responsibility where EO activities are undertaken.

2.21 LAs are responsible for informing stakeholders that a new licence is available for downloading.

2.22 The Officer-in-Charge of the facility is responsible for downloading and displaying the current approved licence for their facilities.

Procedures

2.23 The procedure to implement the requirements of this regulation is Procedure 1 - Licensing of Explosive Ordnance Facilities and Activities.

PROCEDURE 1 - LICENSING OF FACILITIES AND ACTIVITIES

Introduction

1.1 All facilities intended for the storage or processing of Explosive Ordnance (EO) and associated EO activities, eg inspection, maintenance, demolition, embarkation/disembarkation or loading/unloading, are to be 'licensed' by an appointed Licensing Authority, before the facilities are taken into use for those purposes.

1.2 Documents referred to as 'Explosives Limit Licences' (ELL) are used to authorise the use of EO facilities. The format of the licence will depend on the facility and activity to be licensed. The requirements for the preparation and processing of ELL are prescribed in the following paragraphs.

Purpose

1.3 This procedure prescribes licensing requirements for facilities used or intended for use in connection with EO.

Licensing Methodology

1.4 The licensing of an EO facility requires a conscious and deliberate appreciation of the hazards posed by both the EO and activities taking place. Licensing authorities are to ensure that their procedures and logic processes are well documented and that licences issued are able to provide to regulatory or safety auditing authorities the rationale behind the issue of the licence. Licences for NEQ greater than 50 kg are only to be issued after the licensing authority or its delegate has made a physical examination of the facility or site to be licensed and the surrounding environs. Licences are not to be issued solely on the basis of a desk-top or map evaluation.

1.5 The authorised maximum NEQ permitted by a licence is not to be based solely on an evaluation of Potential Explosion Sites (PES) physical capacity and quantity distance availability. History has shown that this methodology usually results in the application of unnecessary or unrealistic constraints on the use of real estate, unrealistic loads being authorised for PES, and little control or thought being given to actual processes which may be conducted, resulting in the likelihood that accidents, if they occur, may tend to be of more significant consequence.

1.6 Licensing authorities must consider inter alia the following factors before a licence is issued:

a. The nature, quantity, hazard classification code and NEQ of the EO to be stored and handled;

b. The nature, construction and orientation of the PES, traversing (if any) and affected ES;

c. The terrain of the facility under review;

d. The physical capacity of the PES including where necessary the requirement for access, fire and stock separation aisles;

e. The hazard, frequency and consequence associated with the risk generated by activities to be, eg a workshop or laboratory handling nitro-glycerine or primary explosives would only be licensed to hold the minimum quantity needed to complete the task in being irrespective of whether other licensing factors would permit greater quantities to be held; and

f. Quantity distance requirements.

1.7 Other factors requiring consideration before a licence is issued are:

a. Safeguarding requirements,

b. Unit activities that could be affected by the licence, and

c. New facilities either being planned or programmed.

1.8 The licensing of process buildings, laboratories and in some cases production facilities, requires additional consideration. For some operations it may be necessary to limit NEQ below that specified on the licence. Approved operating instructions are to be provided by management for all process building, laboratory and production tasks involving EO. As a result of a risk assessment or other considerations, these instructions may define lower NEQ limits than those authorised by the licence. As a general rule, NEQ is to be kept to as low as is reasonably practical commensurate with the task at hand.

1.9 Ammunition lighters, ammunition workboats, crane store lighters, HMA ships and submarines, explosive transport vehicles, explosives material handling equipment, Service or contract aircraft, military vehicles and small vessels, are not required to be licensed in the manner of this instruction to undertake EO activities. However, HMA ships and submarines require 'magazine certification', which is a form of licensing – see ABR 862 Vol 2 for details.

Explosives Limit Licences and Non-Explosive Dangerous Goods Authorisations

1.10 The current ELL are:

a. Large Quantity Facility (LQF) Explosives Limit Licence (Form EO 001) for storage and processing facilities intended for Net Explosives Quantities (NEQ) of 50 kg and above.

b. Small Quantity Facility (SQF) Explosives Limit Licence (Form EO 002) for facilities intended for NEQ of less than 50 kg.

c. Explosives Handling Area (EHA) Explosives Limit Licence (Form EO 003) for wharves, vehicle parking, and aircraft operations areas.

d. Explosives Disposal Area (EDA) Explosives Limit Licence (Form EO 004) for areas assigned to the disposal of explosives by burning or demolition.

e. Fireworks and Display Area (FDA) Explosives Limit Licence (Form EO 005) for areas used for fireworks and explosives displays and demonstrations.

f. Non-Explosive Dangerous Goods (NEDG) Facility Authorisation (Form EO 007) for facilities intended to store non-explosive dangerous goods in an EO Storage Area.

1.11 Authorisation of Explosives Limit Licences. All ELL are to be authorised by an appointed Licensing Authority. In accordance with Regulation 5.2, the Deputy Director Explosive Ordnance Licensing Authority (DDEOLA) at the Directorate of Logistics - Explosive Ordnance (DLOG-EO) is the appointed Licensing Authority (LA)[1] for all EO activities conducted within the Defence organisation except for EO activities:

a. Conducted within the Defence Science and Technology Organisation,

b. Requiring a deviation from DEOP 101 requirements, and

c. Requiring authorisation within Areas of Operations – see paragraphs 1.34 to 1.41.

d. Conducted on Authorised Defence Practice Areas, Training Areas or Ranges – see paragraphs 1.43 and 1.44.

Accordingly, all ELL for EO activities not excluded by the above are to be submitted to the LA for

[1] Throughout this manual DDEOLA will be referred to generically as the Licensing Authority or LA.

authorisation.

Large Quantity Facility (LQF) Licensing Using Form EO 001

1.12 A LQF is any facility, eg building or open area, intended for storage or processing of EO where the total NEQ will normally exceed 50 kg. Quantity Distances (QD) associated with LQF are prescribed in Regulation 5.4.

1.13 A LQF licence authorises the maximum NEQ permitted in the facility. It also provides the following essential information:

a. Licence Number, Facility Number and the authorised use of the facility, ie whether it is a magazine, EO storehouse, EO preparation area, EO workshop, guided weapon workshop, etc.

b. Types of traversing.

c. Building structural details and equipment standards and personnel limits.

d. Limiting Exposed Sites (ES) and the maximum permitted NEQ by Hazard Division (HD).

e. Safeguarding and zone planning details.

f. Authorised Deviations.

g. Limitations imposed by the LA.

h. The date of approval, and the approving authority.

1.14 **Application for LQF Licence (Form EO 001).** The application process for new LQF licences is detailed in Annex A. A specimen of Form EO 001 and a LQF Application Data Sheet are at Appendices 1 and 2 respectively, to Annex A.

Small Quantity Facility (SQF) Licensing Using Form EO 002

1.15 Limited quantities of EO of NEQ less than 50 kg may be stored, handled or processed in specified areas, buildings, rooms or special containers located inside or outside designated EO storage areas. Such a facility is known as a ‘Small Quantity Facility (SQF)’ – see Regulation 4.4 Procedure 13 for details.

1.16 The NEQ of all EO within an SQF is to be in accordance with Regulation 4.4 Procedure 13 paragraph 13.10.

1.17 **Explosives Risk Assessment.** The determination of QD and the quantities of EO to be held in an SQF is to be based on an explosives risk assessment (ERA). The LA is to conduct or arrange for the assessment to be undertaken and determine the appropriate QD and EO quantity allowable for each SQF. Because of the complexity of the risk assessment process and the number of variables to be considered, each SQF case must be assessed individually by the LA. Guidance on the conduct of an ERA is given at Regulation 5.3 Procedure 2.

1.18 **Compatibility Mixing and HD Aggregation Rules.** The compatibility mixing and HD aggregation rules that normally apply under Regulation 4.2, do not apply to SQF Licences. However, where appropriate the LA may specify compatibility mixing requirements on the licence.

1.19 **SQF as an Exposed Site (ES).** Where the explosive consequence of initiation of a Potential Explosion Site (PES) and, in particular, the likelihood of propagation of the explosion to another explosion site is not significantly increased by the presence of SQF, the SQF need not be considered as an ES when determining QD for other PES. This exemption does not apply to inhabited SQF.

1.20 A SQF licence authorises the maximum NEQ permitted in the facility. It will also provide the following essential information:

a. Licence Number, Facility Number and the authorised use of the facility.

b. The limiting ES and the maximum permitted NEQ by HD, and in some cases, by EO nature.

c. Conditions for operating the facility.

d. Reference to the specific ERA.

e. The date of approval, and the approving authority.

1.21 **Common Use SQF.** Throughout Defence several types of SQF have been authorised for similar purposes under the same conditions and requirements. The LA has completed an ERA on these types of SQF, as required at paragraph 1.16, and the results are embodied in Regulation 4.4 Procedure 13. Applications for SQF licences that meet the criteria specified in Regulation 4.4 Procedure 13 may be authorised without further risk assessment.

1.22 **Application for SQF Licence (Form EO 002).** The application process for a SQF licence is detailed in Annex B. A specimen of Form EO 002 and a SQF Application Data Sheet are at Appendices 1 and 2 respectively, to Annex B.

Explosives Handling Area (EHA) Licensing Using Form EO 003

1.23 An EHA is an open area where EO activities are conducted such as vehicle loading, unloading, container stuffing, de-stuffing, aircraft arming and subsequent parking of armed aircraft. EHA activities may be conducted at wharves, container handling areas, airfields, truck parking and transfer areas, marshalling yards and areas set aside for the loading/unloading of armoured fighting vehicles.

1.24 QD associated with EHA are prescribed in Regulation 5.4 and the relevant single service publications.

1.25 An EHA licence authorises the maximum NEQ permitted on the EHA. It also provides for the following essential information:

a. Licence Number, Facility Number and the authorised use of the area.

b. Types of traversing at the site, if any.

c. Area structural details and equipment standards, if applicable.

d. Limiting Exposed Sites (ES) and the maximum permitted NEQ by HD or specific types and quantities of weapons.

e. Safeguarding and master planning details, if applicable.

f. Authorised Deviations.

g. Limitations imposed by the LA.

h. The date of approval, and the approving authority.

1.26 **Application for EHA Licence (Form EO 003).** The application process for an EHA licence is detailed in Annex C. A specimen of Form EO 003 and an EHA Application Data Sheet are at Appendices 1 and 2 respectively, to Annex C.

Explosives Disposal Area (EDA) Licensing Using Form EO 004

1.27 An EDA is an area where EO is destroyed by burning, demolition or functioning.

1.28 Safety distances associated with EDA are prescribed in Regulation 5.5.

1.29 An EDA licence authorises the maximum NEQ for disposal at any one time on the EDA. It will also provide the following essential information:

a. The authorised use of the area.

b. Range boundary distances.

c. The location of all demolition and burning positions, if applicable.

d. Any applicable ES.

e. Authorised Deviations.

f. The maximum permitted NEQ for blast, fragmentation and thermal radiation limits.

g. The Vertical Danger Space limitations.

h. The requirement for a valid Environment Clearance Certificate (ECC) or Environmental Plan (EMP).

i. The licence expiry date.

j. The date of approval, and the approving authority.

1.30 **Application for EDA Licence (Form EO 004).** The application process for an EDA licence is detailed in Annex D. A specimen of Form EO 004 and an EDA Application Data Sheet are at Appendices 1 and 2 respectively, to Annex D.

Fireworks and Display Area (FDA) Licensing Using Form EO 005

1.31 A FDA is an area where fireworks and/or EO are used for displays and/or demonstrations (hereafter called displays). Defence licensed explosives disposal areas, and range areas may also be used. Explosives disposal and range areas are usually open areas with appropriate safety distances for display purposes. Accordingly, such disposal and range areas do not require separate licensing for conduct of displays. However, some disposal and range areas may require separate licensing and advice should be sought from the LA. An FDA licence is only authorised for displays conducted by Defence personnel.

1.32 Safety distances associated with FDA are prescribed in Regulation 4.4 Procedure 12.

1.33 A FDA licence authorises the use of an area for a display. It will also provide the following essential information:

a. Licence Number and the authorised use of the area.

b. The location of all display positions.

c. Any applicable ES to the display.

d. The explosives items and maximum quantities permitted.

e. Environmental aspects and conditions for operating the display.

f. The period of time the licence is authorised.

g. The date of approval, and the approving authority.

1.34 **Application for FDA Licence (Form EO 005).** The application process for a FDA licence is detailed in Annex E. A specimen of Form EO 005 and a FDA Application Data Sheet are given at Appendices 1 and 2 respectively, to Annex E.

Area of Operations Licensing

1.35 An Area of Operations (AO) is an area where the Australian Defence Force (ADF) is involved in war, warlike operations, peacekeeping, disaster relief and similar activities. For licensing purposes, Defence Practice Areas when Major Exercises[2] designed to simulate these activities are undertaken, are to be treated as AO except as provided for at paragraphs 1.36 and 1.41. The requirement for field storage of EO during Operations and Major Exercises is to be determined during the planning phase and approved by Deputy Chief Joint Operations (DCJOPS) in accordance with Regulation 5.2. If approved, AO licences will be governed by the storage requirements dealt with in Regulation 5, supported by a risk assessment at the time of licensing.

1.36 Licensing of EO sites in the AO under contingency situations is to be undertaken when a relatively stable storage environment has been established, as determined by the Force Commander. However, licensing for exercises is to be undertaken prior to any EO arriving at the site.

1.37 The AO licence is to be raised by a person who is technically qualified in EO handling and who is specifically trained in licensing of explosives facilities and associated activities. This person is to be in the AO, because the detail of the licence, and any necessary risk assessment, will rely heavily on knowledge of the site. Under normal circumstances AO licences are to be approved and signed by the DCJOPS or delegate. The delegate is to be a specified officer of the ADF who holds a rank not lower than the rank of LTCOL (Equivalent) or a Defence civilian who is classified at or above Executive Level 1.

NOTE

The level at which an AO licence may be authorised is currently under review. Until this matter is finalised, Regulation 1.2 permits DCJOPS to delegate this authority with the approval of Commander Joint Logistics (CJLOG). Headquarters' staff should use this guidance during planning for Operations and Major Exercises.

1.38 **Explosives Risk Assessment.** Operational circumstances in an AO may dictate the relaxing of requirements specified in Regulation 5.4. Authorisation of the EO activities is to be based on an ERA. The ERA is to be carried out by a person who is technically qualified in EO handling and who is trained in assessing the risks associated with the hazards to EO and the explosive consequences of an EO accident[3].

1.39 The process to be followed when conducting a comprehensive ERA is detailed in Regulation 5.3 Procedure 2.

1.40 An AO licence authorised pursuant of an ERA may place people and facilities at a higher level of risk than that tolerated by current Departmental EO instructions. Such a licence therefore, should be authorised only by DCJOPS. DCJOPS may delegate this authority with the approval of CJLOG.

1.41 However, for Major Exercises on Australian territory, the normal provisions of Regulation 1.2 for Deviations are to be applied. This means that, if a licence cannot meet the Field Storage

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[2] For the purposes of this instruction Major Exercises are defined as being those under the control or sponsorship of Headquarters Joint Operations Command (HQJOC). Minor Exercises are defined and discussed at paragraph 38. If there is any doubt the LA at DEOS is to be consulted.

[3] For ARMY an Explosives Risk Assessment is to be carried out by an Ammunition Technician (minimum rank of WO2) or an Ammunition Technical Officer.

requirements of Regulation 5.4, approval will need to be sought to proceed with the activity. Deviation submissions therefore, should be processed by exercise staff through the Reviewing Authority to an Executive Authority. The EA will process the deviation in accordance with Regulation 1.2. Advice, if required, should be sought from the LA.

Non-Explosive Dangerous Goods Facility Authorisation Using Form EO 007

1.42 Storehouses containing NEDG are to be authorised by the relevant LA. The authorisation is to identify, as a minimum, the Dangerous Goods Classes and quantities that are permitted to be stored together with the conditions or limitations that apply to the particular site. The application process for new NEDG Authorisations is detailed in Annex F. A specimen of Form EO 007 is at Appendix 1 to Annex F.

Delivery of EO

1.43 Except in areas of operation, EO is not to be delivered to or collected from any unlicensed facilities, unit lines and Q stores. However, EO may be delivered to and collected from Defence approved training areas, Defence military ranges, EOLA licensed ports and airfields and civilian ranges. In this instance a civilian range is defined as a range that is subject to a current approved AD 048 (Certificate of Range Safety Compliance) authorised by the Directorate of Training Area Regulation and Policy (DTARP). Delivery and/or collection of EO is also permitted at saluting stations approved in the Army Ceremonial and Protocol Manual Chapter 12 provided, at the point of exchange, the site is under the full control of ADF and/or Defence contracted personnel, non-essential personnel and the public are kept at least 15m away, and adequate fire fighting and security measures are in place.

1.44 If, in the process of transporting EO on the public road system from one location to another, custody of the EO changes from one contracted EO service provider to another contracted EO service provider, the EO is considered to be still in transit until such time as it reaches its delivery destination. Responsibility for the safety and security of the EO remains with the contracted service provider who has custody of the EO.

Minor Exercises

1.45 A 'Minor' Exercise is any exercise not covered by the definition of a 'Major' Exercise defined in the footnote to paragraph 1.35. Such exercises are normally undertaken on Authorised Defence Practice Areas, Training Areas or Ranges managed in accordance with Defence Instruction (General) ADMIN 59-1 Management of Defence Training Areas, e.g. Singleton Army Training Area. Storage of EO under Minor Exercise conditions is only to be in conjunction with a bivouacked force. Provided a Minor Exercise meets the above prescriptions, the storage and handling activities for EO used during the exercise do not require to be licensed in the usual manner for such activities. Where EO is taken to a firing point and is considered ready-use, storage is to comply with tactical doctrine. For echelon storage, ie storage of EO for resupply purposes held at the exercise area, conditions in paragraph 1.46 are to apply. Range Standing Orders and unit's exercise orders are to specify details of storage, transport and disposal arrangements. Under normal circumstances these orders are to be approved and signed by the commander who holds the rank not lower than that of LTCOL (Equivalent). Where a minor exercise is conducted on non-Defence property all EO storage is to be licensed by the LA.

Echelon or Sub Unit Storage

1.46 Echelon storage arrangements are to meet the following requirements as a minimum[4]. These storage arrangements do not require to be licensed by the LA but are to be formally approved by the Officer-in-Charge.

[4] In due course a separate detailed instruction will be prepared to cover storage of EO on Defence Practice Areas, Training Areas and Ranges under Exercise conditions.

a. **Public and Range Control Facilities.** For calculation of separation between any public or Range Control facilities and the EO storage point, QD function D13 ($22.2Q^{1/3}$), minimum distance 400 m, is to be used for the aggregated NEQ of EO of HD 1.1, 1.2 and 1.3.

b. **Camp Site – Protected.** For calculation of separation between the camp site and the EO storage point, QD function 2 x D9 (9.6Q1/3) is to be used for the aggregated NEQ of EO of HD 1.1, 1.2 and 1.3. Minimum distances need not be applied but adequate provision is to be made to shield personnel from fragmentation effects.

c. **Camp Site – Unprotected.** For calculation of separation between an unprotected camp site and the EO storage point, QD function D11 ($14.8Q^{1/3}$) is to be used for the aggregated NEQ of EO of HD 1.1, 1.2 and 1.3. Minimum distances need not be applied.

d. **Training Activities.** For calculation of separation between the site of training activities and the EO storage point, QD function 2 x D9 ($9.6Q^{1/3}$) is to be used for the aggregated NEQ of EO of HD 1.1, 1.2 and 1.3. Minimum distances need not be applied.

e. **Other Explosive Ordnance.** For calculation of separation between adjacent EO storage points, QD function D9 (4.8Q1/3) is to be used for the aggregated NEQ of EO of HD 1.1, 1.2 and 1.3.

f. **Small Arms Ammunition and Pyrotechnics.** Any quantity of SAA and up to 50 kg NEQ of pyrotechnics (EO of HCC 1.2G, 1.3G or 1.4G) are to be stored at least 25m from any facility. For NEQ of pyrotechnics greater than 50 kg, the minimum distance is to be 60 m.

g. **Standard Demolition Kits.** Standard Demolition Kits (SDK) are to be stored as provided for at subparagraphs a. to e. However, a SDK may be stored under the provisions of sub-paragraph f provided the Kit is separately sandbagged with a minimum of 340 mm of sand or earth, to prevent propagation. Under these conditions aggregation is not required.

h. **Compatibility Mixing Rules.** EO compatibility mixing rules do not apply.

i. **Assistance by Technical Specialist.** Guidance, if required, for planning safe storage arrangements, is to be sought from the nearest supporting EO technical specialist.

Licensing of Explosive Ordnance Facilities for Multi Functions

1.47 A facility with more than one functional use is to be authorised for each use, but is normally to be used for one function only at any given time. An example of this is a facility which is normally used as a process building, but which may occasionally be used for storage. A separate licence is to be raised for each function.

1.48 When a facility is not correctly equipped for its secondary function, the licence is to be suitably annotated with details of the precautionary measures required. These details and those concerning any special conditions relating to a particular function are to be entered on the licence.

Licence Reviews

1.49 All licences are to be reviewed by the LA every five (5) years or whenever:

a. Alterations are made to the facility or to explosives policy instructions governing its use,

b. Deviations are granted or withdrawn,

c. Encroachment occurs that affects storage capacity or QD,

d. Any factor arises which affects the authorised NEQ of a PES, or

e. There is a change to the authorised use of the facility.

1.50 The Officer-in-Charge (OIC) of the establishment or unit concerned is responsible for initiating a licence review by the LA whenever any of the factors at paragraph 1.49, or other requirements necessitate a review earlier than the designated cycle, ie earlier than every five years.

Non-Explosives Use of an Explosive Ordnance Facility

1.51 If it is necessary to suspend use, or to make temporary use of an EO facility for a purpose other than that for which it is licensed, the following applies:

a. For periods up to 1 week – the OIC of the establishment or unit is to locally withdraw and suspend the licence for that period, notify the LA and reinstate it at the end of the period; or

b. For periods beyond 1 week – the OIC of the establishment or unit is to provide a copy of a completed AE 319 to the LA and request the LA to suspend the licence. When the facility is again required for its original purpose the OIC is to request reinstatement of the licence. The LA will determine whether a new licence application is required.

In both instances the OIC is to ensure the facility is certified free from explosives before the facility is made available for its alternative non-explosives use. A copy of the Clearance Certificate, Form AE 319, for EO Facilities is to be downloaded from Web forms and completed. The certificate is to be forwarded to the LA for suspensions beyond 1 week.

Vacating Licensed Areas or Facilities

1.52 Annex G contains the procedures to be used when licensed EO areas or facilities is no longer required permanently for the purpose for which it is licensed. Clearance certificates are not required for NEDG Authorised areas.

Register of Current and Cancelled Explosives Limit Licences

1.53 The LA is to maintain a Master Register, by establishment/unit, of all current ELL within Defence.

1.54 The LA is to retain copies of cancelled ELL for a period of at least three (3) years from the date of cancellation Exemptions from Licensing

Reporting of Breaches of Authorised Explosives Limits

1.55 Explosives limits authorised by ELL must never be exceeded and appropriate safeguards must be instituted to guard against this eventuality. Any instances of limits being exceeded are to be reported immediately to the OIC of the establishment or unit concerned and corrected. The OIC is to initiate an investigation into the breach and report the occurrence immediately to the LA, stating:

a. The extent of the breach,

b. The reasons for its occurrence, and

c. The actions taken/proposed to safeguard against any further occurrences. Where a system for electronic notification of breaches is available, eg COMSARM, the above report to the LA is not required provided the breach is notified electronically to the OIC of the establishment or unit concerned and to the LA.

Explosive Ordnance Facility Authorisation Register

1.56 Each establishment or unit holding EO is to maintain an EO Facility Authorisation Register. This register is to consist of a folder(s) containing the following:

a. A list of all EO facilities under the responsibility of the establishment or unit. The list is to indicate:

(1) The facility number and/or designation, and

(2) The use for which each facility is licensed.

b. The approved current ELL for each facility. The ELL is to be downloaded from the Licensing Authority webpage.

c. A current copy of the establishment's Safeguarding Map(s) or reference to where it is held.

d. The original of the form EO 077 – Authorised Use and Explosives Content of an Explosives Facility (applicable only to SQFs).

Annexes:

A. Application Process for Large Quantity Facility (LQF) Explosives Limit Licence (Form EO 001)
B. Application Process for Small Quantity Facility (SQF) Explosives Limit Licence (Form EO 002)
C. Application Process for Explosives Handling Area (EHA) Explosives Limit Licence (Form EO 003)
D. Application Process for Explosives Disposal Area (EDA) Explosives Limit Licence (Form EO 004)
E. Application Process for Fireworks and Display Area (FDA) Explosives Limit Licence (Form EO 005)
F. Application Process for Non-Explosive Dangerous Goods Facility Authorisation (Form EO 007)
G. Vacating Explosive Ordnance Areas and Facilities

ANNEX A

APPLICATION PROCESS FOR LARGE QUANTITY FACILITY (LQF) EXPLOSIVES LIMIT LICENCE (FORM EO 001)

Application Process for New Licence

1. An application for a new Large Quantity Facility (LQF) licence Form EO 001 (a specimen of an LQF Licence is at Appendix 1) is to be processed as follows:

a. The applicant is to advise the Licensing Authority (LA) of the need for a LQF licence. The initial contact should be by telephone, followed by the Application Data Sheet.

b. The Application Data Sheet is to be completed by the applicant ensuring as much information as possible is given. In preparing the Application Data Sheet advice should be sought, in the first instance, from the Base Armament Manager (BAM), Explosives Custodian Officer (ECO) or the local E&IG regional services office. The LA may be consulted when further advice is required. The Application Data Sheet is to be downloaded from the DEOLC EO Licensing Authority web page.

c. The application is to be forwarded to the BAM, ECO or E&IG regional service office for checking, comment and endorsement before on-forwarding to the LA for processing. The LQF application process can take up to 30 working days to complete from the date the LA receives the appropriate information.

d. The LA will review the application and make a determination on whether or not to issue a licence. If the facility can not be licensed the LA will advise the originator through the endorsee.

e. When a permanent licence is released, the licence will be posted on the EO Licences page on the DEOLC website. An email will be sent to stakeholders advising that the licence has been released on the website. EO Regulation will retain the original hard copy for the Master Register

2. Normally, EO storage or other activities within a LQF are to be licensed by the LA, before commencing. In emergencies the LA may give written approval for EO activities to proceed prior to a formal licence being issued.

Application Process for Changes to Existing Licence

3. Applications for changes to existing licenses are to be processed as follows:

a. The applicant is to advise the LA of the need for a change to an existing LQF licence. The initial advice may be by telephone with a follow-up fax, e-mail or message.

b. Details of the proposed change and an explanation of the need for the change is to be forwarded to the LA for consideration.

c. Further processing of any change will be in accordance with sub-paragraphs 1d and 1e.

Appendixes:

1. Specimen of Large Quantity Facility (LQF) Explosives Limit Licence (Form EO 001)

APPENDIX 1 TO ANNEX A

SPECIMEN OF LARGE QUANTITY FACILITY (LQF) EXPLOSIVES LIMIT LICENCE (FORM EO 001)

Australian Government
Department of Defence

Explosives Limit Licence Large Quantity Facility (LQF)

Form: EO 001
Revised: Jul 2015

BASE	WAIVERS	LICENCE No
FACILITY NAME/No	USE	DUE FOR REVIEW
PES TYPE	TRAVERSE TYPE	CPB DISTANCE [m]

SAFEGUARDING INFORMATION

PTRD [m]: IBD [m]: 2xIBD [m]:

EXPOSED SITES

ES Design:

PES

ES Group							
ES No/Name							
Distance [m]							
Distance [m]							
Distance [m]							

REMARKS

AUTHORISED MAX NEQ (Mixing rules in accordance with eDEOP 101 apply)
Check above remarks for exemptions and special conditions

HD 1.1 [kg]	HD 1.2.1 [kg]	HD 1.2.2 [kg]	HD 1.3.3 [kg]	HD 1.3.4 [kg]	HD 1.4 [kg]

Signature:		Appointment:		Telephone:	
		Name:		Authorisation Date:	

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**APPENDIX 1 TO
ANNEX A**

Australian Government
Department of Defence

Explosives Limit Licence
Large Quantity Facility (LQF)

Form: EO 001
Revised: Jul 2015

BASE	WAIVERS	LICENCE No
FACILITY NAME/No	USE	DUE FOR REVIEW
PES TYPE	TRAVERSE TYPE	CPB DISTANCE [m]

SAFEGUARDING INFORMATION

PTRD [m]: ____ IBD [m]: ____ 2xIBD [m]: ____

EXPOSED SITES

ES Design:

PES

ES Group							
ES No/Name							
Distance [m]							
Distance [m]							
Distance [m]							

NET EXPLOSIVE QUANTITY (NEQ) [kg]

HD 1.1							
HD 1.2.1							
HD 1.2.2							
HD 1.3.3							
HD 1.3.4							

LICENCE LIMITS

	HD 1.1	HD 1.2.1	HD 1.2.2	HD 1.3.3	HD 1.3.4	HD 1.4
NEQ by Qty Distance [kg]:						Authorised Limits
NEQ by Physical Capacity [kg]:						Authorised Limits
Authorised Max NEQ [kg]:						

SAFEGUARDING DETERMINATION TABLE

COPY (PRINTED FROM EOLA WEBSITE)

ANNEX B

APPLICATION PROCESS FOR SMALL QUANTITY FACILITY (SQF) EXPLOSIVES LIMIT LICENCE (FORM EO 002)

Application Process for New Licence

1. An application for a new SQF licence Form EO 002 (specimen of an SQF Licence is at Appendix 1) is to be processed as follows:

a. The applicant is to advise the Licensing Authority (LA) of the need for a SQF licence. The initial contact should be by telephone, followed by the Application Data Sheet.

b. The Application Data Sheet is to be completed by the applicant ensuring as much information as possible is given. In preparing the Application Data Sheet advice should be sought, in the first instance, from the Base Armament Manager (BAM), Explosives Custodian Officer (ECO) or the local regional services office. The LA may be consulted when further advice is required. The Application Data Sheet is to be downloaded from the DEOLC EO Licensing Authority web page.

c. The application is to be forwarded to the BAM, ECO or RSO for checking, comment and endorsement before on-forwarding to the LA for processing. The SQF application process can take up to 30 working days to complete from the date the LA receives the appropriate information.

d. The LA will review the application and determine whether or not an Explosives Risk Assessment (ERA) is required before making a determination on whether or not to issue a licence. If an ERA is required Section 2 of the Application Data Sheet will be completed by the LA.

e. If the facility can not be licensed the LA will advise the originator through the endorsee.

f. When a permanent licence is released, the licence will be posted on the EO Licences page on the DEOLC website. An email will be sent to stakeholders advising that the licence has been released on the website. EO Regulation will retain the original hard copy for the Master Register.

2. Normally, EO storage or other activities within a SQF are to be licensed by the LA, before commencing. In emergencies the LA may give written approval for EO activities to proceed prior to a formal licence being issued.

Application Process for Changes to Existing Licence

3. Applications for changes to existing licenses are to be processed as follows:

a. The applicant is to advise the LA of the need for a change to an existing SQF licence. The initial advice may be by telephone with a follow-up fax, e-mail or message.

b. Details of the proposed change and an explanation of the need for the change is to be forwarded to the LA for consideration.

c. Further processing of any change will be in accordance with sub-paragraphs 1d, e and f.

Appendices:
1. Specimen of Small Quantity Facility (SQF) Explosives Limit Licence (Form EO 002)

APPENDIX 1 TO ANNEX B

SPECIMEN OF SMALL QUANTITY FACILITY (SQF) EXPLOSIVES LIMIT LICENCE (FORM EO 002)

Australian Government
Department of Defence

Explosives Limit Licence
Small Quantity Facility (SQF)

Form: EO 002
Revised: Jul 2015

BASE	USE	LICENCE No
FACILITY NAME/No	PES TYPE	DUE FOR REVIEW

EXPOSED SITES

ES Design :

ES Group :					
ES No/Name :					
Distance [m] :					

REMARKS
(special conditions, justification, summary of risk assessment or time limit)

AUTHORISED NEQ
Check above remarks for exemptions and special conditions

HD 1.1 [kg]	HD 1.2.1 [kg]	HD 1.2.2 [kg]	HD 1.3.3 [kg]	HD 1.3.4 [kg]	HD 1.4 [kg]

Signature:		Appointment:		Telephone:	
		Name:		Authorisation Date:	

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**APPENDIX 1 TO
ANNEX B**

Australian Government
Department of Defence

Explosives Limit Licence Small Quantity Facility (SQF)

Form: EO 002
Revised: Jul 2015

BASE	USE	LICENCE No

FACILITY NAME/No	PES TYPE	DUE FOR REVIEW

AMPLIFYING NOTES

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ANNEX C

APPLICATION PROCESS FOR EXPLOSIVES HANDLING AREA (EHA) EXPLOSIVES LIMIT LICENCE (FORM EO 003)

Application Process for New Licence

1. An application for a new Explosives Handling Area (EHA) licence Form EO 003 (a specimen of EHA Licence is at Appendix 1) is to be processed as follows:

a. The applicant is to advise the Licensing Authority (LA) of the need for an EHA licence. The initial contact should be by telephone, followed by the Application Data Sheet.

b. The Application Data Sheet is to be completed by the applicant ensuring as much information as possible is given. In preparing the Application Data Sheet advice should be sought, in the first instance, from the Base Armament Manager (BAM), Explosives Custodian Officer (ECO) or the local E&IG regional services office. The LA may be consulted when further advice is required. The Application Data Sheet is to be downloaded from the DEOLC EO Licensing Authority web page.

c. The application is to be forwarded to the BAM, ECO or E&IG regional service office for checking, comment and endorsement before on-forwarding to the LA for processing. The EHA application process can take up to 30 working days to complete from the date the LA receives the appropriate information.

d. The LA will review the application and make a determination on whether or not to issue a licence. If the facility can not be licensed the LA will advise the originator through the endorsee.

e. If the facility can not be licensed the LA will advise the originator through the endorsee.

f. When a permanent licence is released, the licence will be posted on the EO Licences page on the DEOLC website. An email will be sent to stakeholders advising that the licence has been released on the website. EO Regulation will retain the original hard copy for the Master Register

2. Normally, EO storage or other activities within an EHA are to be licensed by the LA, before commencing. In emergencies the LA may give written approval for EO activities to proceed prior to a formal licence being issued.

Application Process for Changes to Existing Licence

3. Applications for changes to existing licenses are to be processed as follows:

a. The applicant is to advise the LA of the need for a change to an existing EHA licence. The initial advice may be by telephone with a follow-up fax, e-mail or message.

b. Details of the proposed change and an explanation of the need for change is to be forwarded to the LA for consideration.

c. Further processing of any change will be in accordance with sub-paragraphs 1d and e.

Appendices:
1. Specimen of Explosives Handling Area (EHA) Explosives Limit Licence (Form EO 003)

**APPENDIX 1 TO
ANNEX C**

SPECIMEN OF EXPLOSIVE HANDLING AREA (EHA) EXPLOSIVES LIMIT LICENCE (FORM EO 003)

Australian Government
Department of Defence

**Explosives Limit Licence
Explosives Handling Area (EHA)**

Form: EO 003
Revised: Jul 2015

BASE	WAIVERS	LICENCE No
FACILITY NAME/No	USE	DUE FOR REVIEW
PES TYPE	TRAVERSE TYPE	CPB DISTANCE [m]

SAFEGUARDING INFORMATION

PTRD [m]: IBD [m]: 2xIBD [m]:

EXPOSED SITES

ES Design:

PES

ES Group							
ES No/Name							
Distance [m]							
Distance [m]							
Distance [m]							

REMARKS

AUTHORISED MAX NEQ (Mixing rules in accordance with eDEOP 101 apply)
Check above remarks for exemptions and special conditions

HD 1.1 [kg]	HD 1.2.1 [kg]	HD 1.2.2 [kg]	HD 1.3.3 [kg]	HD 1.3.4 [kg]	HD 1.4 [kg]

Signature:	Appointment:	Telephone:
	Name:	Authorisation Date:

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**APPENDIX 1 TO
ANNEX C**

Australian Government
Department of Defence

Explosives Limit Licence
Explosives Handling Area (EHA)

Form: EO 003
Revised: Jul 2015

BASE	WAIVERS	LICENCE No
FACILITY NAME/No	USE	DUE FOR REVIEW
PES TYPE	TRAVERSE TYPE	CPB DISTANCE [m]

SAFEGUARDING INFORMATION

PTRD [m]: IBD [m]: 2xIBD [m]:

EXPOSED SITES

ES Design:

PES

ES Group							
ES No/Name							
Distance [m]							
Distance [m]							
Distance [m]							

NET EXPLOSIVE QUANTITY (NEQ) [kg]

HD 1.1							
HD 1.2.1							
HD 1.2.2							
HD 1.3.3							
HD 1.3.4							

LICENCE LIMITS

	HD 1.1	HD 1.2.1	HD 1.2.2	HD 1.3.3	HD 1.3.4	HD 1.4
NEQ by Qty Distance [kg]:						Authorised Limits
NEQ by Physical Capacity [kg]:						Authorised Limits
Authorised Max NEQ [kg]:						

SAFEGUARDING DETERMINATION TABLE

ANNEX D

APPLICATION PROCESS FOR EXPLOSIVES DISPOSAL AREA (EDA) EXPLOSIVES LIMIT LICENCE (FORM EO 004)

Application Process for New Licence

1. An application for a new EDA licence Form EO 004 (a specimen of an EDA Licence is at Appendix 1) is to be processed as follows:

a. The applicant is to advise the Licensing Authority (LA) of the need for an EDA licence. The initial contact should be by telephone, followed by the Application Data Sheet.

b. The Application Data Sheet is to be completed by the applicant ensuring as much information as possible is given. In preparing the Application Data Sheet advice should be sought, in the first instance, from the Base Armament Manager (BAM), Explosives Custodian Officer (ECO) or the local E&IG regional services office. The LA may be consulted when further advice is required. The Application Data Sheet is to be downloaded from the DEOLC EO Licensing Authority web page.

Note

Proposals and licences for burning or demolition grounds must comply with Defence policy and procedures on environmental protection and biodiversity conservation. An environmental impact assessment (EIA) and resulting Environmental Clearance Certificate (ECC) is required to accompany the licence application. See Regulation 5.5 Procedure 1 paragraph 1.15 for the process of gaining an ECC.

c. The application is to be forwarded to the BAM, ECO or RSO for checking, comment and endorsement before on-forwarding to the LA for processing. The EDA application process can take up to 30 working days to complete from the date the LA receives the appropriate information.

d. The LA will review the application and make a determination on whether or not to issue a licence. If the facility can not be licensed the LA will advise the originator through the endorsee.

e. When a permanent licence is released, the licence will be posted on the EO Licences page on the DEOLC website. An email will be sent to stakeholders advising that the licence has been released on the website. EO Regulation will retain the original hard copy for the Master Register.

2. Normally, an EDA is to be licensed by the LA before disposal work is undertaken. However, in emergencies the LA may consider giving written approval for EO activities to proceed prior to a formal licence being issued.

Application Process for Changes to Existing Licence

3. Applications for changes to existing licenses are to be processed as follows:

a. The applicant is to advise the LA of the need for a change to an existing EDA licence. The initial advice may be by telephone with a follow-up fax, e-mail or message.

b. Details of the proposed change and an explanation of the need for the change is to be forwarded to the LA for consideration.

c. Further processing of any change will be in accordance with sub-paragraphs 1d and 1e.

ANNEX D

Appendices:

1. Specimen of Explosives Disposal Area (EDA) Explosives Limit Licence (Form EO 004)

APPENDIX 1 TO ANNEX D

SPECIMEN OF EXPLOSIVES DISPOSAL AREA (EDA) EXPLOSIVES LIMIT LICENCE (FORM EO 004)

Australian Government
Department of Defence

Explosives Limit Licence
Explosives Disposal Area (EDA)

Form: EO 004
Revised: Jul 2015

BASE		LICENCE No
FACILITY NAME/No	FACILITY TYPE	DUE FOR REVIEW

EXPOSED SITES

ES Design :

						Distance to Range Boundary (m)
ES Group :						
ES No/Name :						
Distance [m] :						

FACILITY DESCRIPTION

REMARKS
(special conditions, justification, summary of risk assessment or time limit)

AUTHORISATION

TO CONDUCT ANY DISPOSAL OPERATIONS USING THIS LICENCE, A VALID ENVIRONMENTAL CLEARANCE CERTIFICATION (ECC), OR ENVIRONMENTAL MANAGEMENT PLAN (EMP) IS REQUIRED AND ALL ACTIVITIES MUST BE CONDUCTED IAW eDEOP 101, REGULATION 5.5, PROCEDURE 1, AND RANGE STANDING ORDERS.

APPROVED LIMITS:

SINGLE AMMUNITION (the mass of the item being destroyed plus the mass of the demolition charge)		kg
STACKED AMMUNITION (the mass of the largest single item in the stack)		kg
BLAST LIMIT: Approved limit is the Net Explosive Quantity (NEQ) in kgs of the explosive being destroyed		kg

THERMAL RADIATION:

Distance to Site in metres (minimum 100m)		m
Authorised Maximum Burn NEQ of propellant		kg
Authorised Maximum Burn NEQ of EO other than propellant		kg

VERTICAL DANGER SPACE MINIMUM LIMIT:

The limit is calculated for NOTAM's as required (in feet):	0	ft

Signature:		Appointment:		Telephone:	
		Name:		Authorisation Date:	

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APPENDIX 1 TO ANNEX D

Australian Government
Department of Defence

Explosives Limit Licence
Explosives Disposal Area (EDA)

Form: EO 004
Revised: Jul 2015

BASE | **LICENCE No**

FACILITY NAME/No | **FACILITY TYPE** | **DUE FOR REVIEW**

APPROVED RANGE LIMITS NOTES

1. Where the fragmentation envelope is not prescribed by existing data, the formulae given are to be vide eDEOP 101
2. Multi Item limit formulae is valid for demolition involving simiarly filled munitions,functioned in intimate contact & where detonation is achieved
3. Formulae given are to be used vide eDEOP 101
4. Vertical Danger Space (VDS) Limits formulae given are to be used vide Australian Ordanance Council (AOC) Proceeding 205.92

FRAGMENTATION SAFETY DISTANCE — APPROVED LIMITS

Single ammunition item or encased bulk explosive	Total Mass (W) in kgs		$D = 370W^{1/5}$		metres	=	SINGLE ITEM
	Distance (D) in metres		$W = (D/370)^5$		kgs		kgs
Stacked ammunition	Total Mass (W) in kgs		$D = 650W^{1/5}$		metres	=	MULTI ITEM
	Distance (D) in metres		$W = (D/650)^5$		kgs		kgs

BLAST SAFETY DISTANCE — APPROVED LIMIT

Blast limit	NEQ (Q) in kgs		$D = 140Q^{1/3}$		metres	=	BLAST LIMIT kgs
	Distance (D) in metres		$Q = (D/140)^3$		kgs		

VERTICAL DANGER SPACE CRITERIA

Calculation of the minimum Vertical Safety Distance is determined by the above formulas. These formulas are governed by the AOC Proceeding 205.92 dated Jul 1992. The proceeding indicates that above three formulas should calculated and the larger distance selected, next round up to the next 100ft and add 500ft for safety. A minimum of 1500 feet above ground level (AGL) is required.

VERTICAL DANGER SPACE LIMITS — APPROVED LIMITS

Single ammunition item or encased bulk explosive	Total Mass (W) in kgs		$D = 314W^{1/5}$		metres	=		kgs
	Distance (D) in metres		$W = (D/314)^5$		kgs			m
Stacked ammunition	Total Mass (W) in kgs		$D = 470W^{1/5}$		metres	=		kgs
	Distance (D) in metres		$W = (D/470)^5$		kgs			m
Blast limit	NEQ (Q) in kgs		$D = 140Q^{1/3}$		metres	=		kgs
	Distance (D) in metres		$Q = (D/140)^3$		kgs			m

Single Ite
Multi Item
Blast Limit

= Calculated VDS Minimum Limit (m) = VDS Minimum Limit (Feet) This includes 500 feet AGL = Rounded up to next 100ft = **APPROVED VDS Minimum Limit** FEET

THERMAL RADIATION

The formulas utilised below are from the Allied Ammunition Storage and Transport Publication 1 (AASTP-1) - NATO Safety Principles for the storage of Military Ammunition and Explosives - September 2003 - Part II, Chapter 5, Section IV.

Distance to Site (minimum 100m)		metres	**NEQ of propellant**		kgs
Permitted NEQ		kgs	Safety Distance Required for above NEQ		metres
Radius of the fireball (Above Ground)		metres	Radius of the fireball (Above Ground)		metres
Radius of the fireball (Ground Level)		metres	Radius of the fireball (Ground Level)		metres
Height of the fireball		metres	Height of the fireball		metres
Fireball duration		seconds	Fireball duration		seconds
Thermal Flux (set at 1.2)		kWatt/m2	Thermal Flux (set at 1.2)		kWatt/m2

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ANNEX E

APPLICATION PROCESS FOR FIREWORKS AND DISPLAY AREA (FDA) EXPLOSIVES LIMIT LICENCE (FORM EO 005)

Application Process for New Licence

1. An application for a new Fireworks and Display Area (FDA) licence Form EO 005 (specimen of a FDA Licence is at Appendix 1) is to be processed as follows:

a. The applicant is to advise the Licensing Authority (LA) of the need for a FDA licence. The initial contact should be by telephone, followed by the Application Data Sheet.

b. The Application Data Sheet is to be completed by the applicant ensuring as much information as possible is given. In preparing the Application Data Sheet advice should be sought, in the first instance, from the Base Armament Manager (BAM), Explosives Custodian Officer (ECO) or the local E&IG regional services office. The LA may be consulted when further advice is required. The Application Data Sheet is to be downloaded from the Licensing Authority web page.

c. The application is to be forwarded to the BAM, ECO or E&IG regional service office for checking, comment and endorsement before on-forwarding to the LA for processing. The FDA application process can take up to 30 working days to complete from the date the LA receives the appropriate information.

d. The LA will review the application and make a determination on whether or not to issue a licence. If the facility can not be licensed the LA will advise the originator through the endorsee.

e. When a permanent licence is released, the licence will be posted on the Licensing Authority web page an email will be sent to stakeholders advising that the licence has been released on the website. EO Regulation will retain the original hard copy for the Master Register.

2. Normally, FDA activities are to be licensed by the LA before commencing. The LA may give written approval for FDA activities to proceed prior to a formal licence being issued.

Application Process for Changes to Existing Licence

3. Applications for changes to existing licenses are to be processed as follows:

a. The applicant is to advise the LA of the need for a change to an existing FDA licence. The initial advice may be by telephone with a follow-up fax, e-mail or message.

b. Details of the proposed change and an explanation of the need for the change is to be forwarded to the LA for consideration.

c. Further processing of any change will be in accordance with sub-paragraphs 1d and 1e.

Appendix:
1. Specimen of Fireworks and Display Area (FDA) Explosives Limit Licence (Form EO 005)

**APPENDIX 1 TO
ANNEX E**

SPECIMEN OF FIREWORKS AND DISPLAY AREA (FDA) EXPLOSIVES LIMIT LICENCE (FORM EO 005)

Australian Government
Department of Defence

Explosives Limit Licence
Fireworks & Display Area (FDA)

Form: EO 005
Revised: Jul 2015

BASE	USE	LICENCE No

FACILITY NAME/No	PES TYPE	DUE FOR REVIEW

DISPLAY AREA
Description of Display Area

REMARKS
(special conditions, justification, summary of risk assessment or time limit)

AUTHORISATION

Signature:		Appointment:		Telephone:	
		Name:		Authorisation Date:	

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APPENDIX 1 TO ANNEX E

Australian Government
Department of Defence

Explosives Limit Licence Fireworks & Display Area (FDA)

Form: EO 005
Revised: Jul 2015

BASE	USE	LICENCE No
FACILITY NAME/No	**PES TYPE**	**DUE FOR REVIEW**

ANNEX F

APPLICATION PROCESS FOR NON-EXPLOSIVE DANGEROUS GOODS FACILITY AUTHORISATION (FORM EO 007)

Application Process for New Authorisation

1. An application for a new Non-Explosive Dangerous Goods (NEDG) Facility Authorisation Form EO 007 (specimen of a NEDG Authorisation is at Appendix 1) is to be processed as follows:

a. The applicant is to advise the Licensing Authority (LA) of the need for a NEDG authorisation. The initial contact should be by telephone, followed by the Application Data Sheet.

b. The Application Data Sheet is to be completed by the applicant ensuring as much information as possible is given. In preparing the Application Data Sheet advice should be sought, in the first instance, from the Base Armament Manager (BAM), Explosives Custodian Officer (ECO) or the local E&IG regional services office. The LA may be consulted when further advice is required. The Application Data Sheet is to be downloaded from the Licensing Authority web page.

c. The application is to be forwarded to the BAM, ECO or E&IG regional services office for checking, comment and endorsement before on-forwarding to the LA for processing. The NEDG application process can take up to 30 working days to complete from the date the LA receives the appropriate information.

d. The LA will review the application and make a determination on whether or not to issue an authorisation. If the facility cannot be authorised the LA will advise the originator through the endorsee.

e. When a NEDG facility is authorised, the authorisation will be posted on the EO Licences page on the Licensing Authority website. An email will be sent to stakeholders advising that the authorisation has been released on the website. The LA will retain the original hard copy for the Master Register.

2. Normally, NEDG storage or other activities are to be authorised by the LA before commencing. The LA may give written approval for NEDG storage activities to proceed prior to a formal authorisation being issued.

Application Process for Changes to Existing Authorisations

3. Applications for changes to existing authorisations are to be processed as follows:

a. The applicant is to advise the LA of the need for a change to an existing NEDG authorisation. The initial advice may be by telephone with a follow-up fax, e-mail or message.

b. Details of the proposed change and an explanation of the need for the change are to be forwarded to the LA for consideration.

c. Further processing of any change will be in accordance with sub-paragraphs 1d and 1e.

Appendix:
1. Specimen of Non-Explosive Dangerous Goods (NEDG) Facility Authorisation (Form EO 007)

**APPENDIX 1 TO
ANNEX F**

SPECIMEN OF NON-EXPLOSIVE DANGEROUS GOODS (NEDG) FACILITY AUTHORISATION (FORM EO 007)

Australian Government
Department of Defence

Authorisation Limit Non-Explosive Dangerous Goods Storage (DG)

Form: EO 007
Revised: Jul 2015

BASE	USE	AUTHORISATION No

FACILITY NAME/No	NEDG TYPE	DUE FOR REVIEW

EXPOSED SITES

ES Design:

ES Group No:					
ES No/Name:					
Distance:					

REMARKS
(special conditions, justification, summary of risk assessment or time limit)

AUTHORISATION

DG Total	Class 2	Class 3	Class 4	Class 5	Class 6	Class 7	Class 8	Class 9
	☐	☐	☐	☐	☐	☐	☐	☐

Signature:		Appointment:		Telephone:	
		Name:		Authorisation Date:	

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**APPENDIX 1 TO
ANNEX F**

Australian Government
Department of Defence

Authorisation Limit Non-Explosive Dangerous Goods Storage (DG)

Form: EO 007
Revised: Jul 2015

BASE	USE	AUTHORISATION No
FACILITY NAME/No	NEDG TYPE	DUE FOR REVIEW

ADDITIONAL REMARKS

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ANNEX G

VACATING EXPLOSIVE ORDNANCE AREAS AND FACILITIES

Introduction

1. It is essential that areas, facilities and burning/demolition grounds which may at any time have been used for the storage, handling or destruction of Explosive Ordnance (EO) be cleared of all EO, Unexploded Explosive Ordnance (UXO), and associated substances, and properly certified before being submitted for disposal or used for other purposes. Although it is not possible to give an unconditional certification, the procedures below are to be rigidly implemented.

Purpose

2. This procedure prescribes the procedures for vacating and certifying an area, facility or burning/demolition ground that has been previously used for the storage, handling and/or the destruction of EO.

Higher Policy

3. This procedure is to be read in conjunction with Defence Instruction General Administration 63-1 *Management of Land Affected by Unexploded Ordnance*. (DI (G) ADMIN 63-1) which contains policy and responsibilities within the Services and the Department of Defence for the management of land affected by UXO in the context of national policy.

Procedures for Vacation and Certification

4. When an EO area, facility or burning/demolition ground is closed, reallocated to a non-explosive function or is released to another Department for non-explosive use, the following procedure is to be adopted and supervised by a suitably qualified officer (in accordance with Regulation 1.1) nominated by the Officer-in-Charge (OIC). For licensed facilities a copy of the Clearance Certificate (AE 319, available on Web Forms) and map is to be forwarded to the Licensing Authority (LA) with a request to withdraw the Explosives Limit Licence (ELL). Once the LA withdraws the ELL, the matter is to be referred to the Property Services Branch within Infrastructure Division, Defence Estate and Infrastructure Group (E&IG):

a. **Research.** Before any physical search is started, establishment/depot files, records, logs, registers and diaries should be researched to ascertain the areas of most likely contamination.

b. **Search.** Following the clearance of the area and buildings of EO, a thorough visual search of the facilities involved is to be undertaken to ensure that no EO or substances remain:

(1) In the area/ground;

(2) At the facility; and

(3) Within a radius of 50 m from the facility, or the distance to the nearest other EO facility (whichever is the least).

An instrumented search of the area using the latest methods available is to be arranged where this is considered necessary.

c. **Deep Search.** The search of the burning/demolition ground is to be carried out to a depth of at least 1.5 m, using the latest surface-locator equipment. Clearance to a greater depth may be required depending on the future use of the land.

d. **White Phosphorus (WP) Disposal Areas.** Areas that have been used for the disposal of EO containing WP, are to be ploughed over and raked by personnel wearing protective clothing until no trace of WP remains.

e. **Explosive Contamination.** Any place where loose substances or exposed explosives could have been handled is to be decontaminated using the latest methods available.

f. **Chemical Disposal Areas.** Where a chemical disposal area exists, it is to be fenced and marked with signs and symbols indicating chemically contaminated ground. The clearance of such areas is to be conducted as a full chemical disposal task, with appropriate protective dress requirements. The services of appropriately qualified personnel may be required for advice and testing of residue, e.g. Weapons System Division in the Defence Science and Technology Group. If clearance is not required or not considered feasible, a note to the effect that this area has not been cleared is to be annotated on the clearance certificate.

g. **Inert Components/Produce.** Any inert components or produce (e.g. shot, cartridge cases, fuze bodies, packaging) are to be cleared from the area and disposed of in an appropriate manner.

h. **Certificate of Clearance.** A Certificate of Clearance (AE 319, available on Web Forms) is to be prepared for each area, facility and/or burning/demolition ground and signed by the supervising officer. The boundaries of the area covered by the certificate are to be marked on a map that is to be retained with the certificate on an establishment file until required in support of transfer. For licenced facilities a copy of the certificate and map is to be forwarded to the LA with a request to withdraw the ELL.

Alteration or Demolition of an EO Facility

5. EO storage and handling facilities attract a high level of investment. Therefore, it is important to protect the long-term viability of these facilities. If an EO facility is to be altered in any way or demolished, approval must be sought from the Directorate of Logistics - Explosive Ordnance (DLOG-EO). The proposed design or demolition plan must be forwarded to DLOG-EO before any contracts for the work are let.

REGULATION 5.3 - EXPLOSIVES RISK MANAGEMENT

General Overview

3.1 Licensing practices for the storage of Explosive Ordnance (EO) within the Australian Defence Organisation (ADO) are based on criteria referred to as Quantity Distance (QD) rules (see Regulation 5.4). QD principles achieve a compromise between absolute safety to personnel and property and a practical consideration of cost. QD rules are based on experimental data and are applied where the Net Explosive Quantity (NEQ) is greater than 50 kg and remain the basis ensuring safety for explosive storage and handling. Explosive Risk Management (ERM) is not intended to replace QD principles but compliment them.

3.2 Quantities of EO of less than 50 kg NEQ required for specific operational or training use may be stored or processed in designated explosive ordnance facilities, areas, buildings, rooms or special containers usually located outside designated EO storage areas. Such a facility is known as a 'Small Quantity Facility' (SQF).

Requirements

3.3 **ERM Techniques.** ERM techniques must not be used as an alternate to QD rules for facilities holding greater than 50 kg NEQ without the formal approval of the Directorate of Ordnance Safety (DOS).

3.4 ERM Techniques outlined in this regulation must be used to:

a. Assist in the licensing of Small Quantity Facilities (SQF) holding less than 50 kg NEQ of explosives other than HD 1.4;

b. Support applications for deviations; and

c. Support specific studies in relation to EO storage, handling and transportation requirements.

3.5 **Licensing SQF.** Explosive Ordnance facilities classified as SQF, or other sites holding less than 50 kg NEQ, other than HD 1.4, are to be licensed by semi-quantitative Explosives Risk Assessment (ERA), see Procedure 1. Each ERA is to be peer reviewed by suitably qualified and experienced staff. If consultants from outside Defence are used, the contracting organisation is to verify the competence of the consultant in conducting ERA.

3.6 **Explosives Risk Assessment.** Part of the risk management process defined in AS/NZS ISO 31000:2009 is the conduct of a risk assessment. A risk assessment is used to calculate the risk associated with a particular hazard. An ERA may be undertaken to various degrees of refinement depending on the information and data available.

3.7 **ERA Methodology.** Risk assessments can be conducted using three methodologies: Qualitative, semi-quantitative, and quantitative. A qualitative risk assessment uses descriptive scales of risk levels, a quantitative assessment uses numerical values, and a semi-quantitative assessment uses a combination of both numerical values and descriptive scales to determine the level of risk. Methodologies to conduct an ERA in accordance with policy defined in this chapter are detailed in Procedure 1 and 2.

3.8 **Risk Criteria.** Storage and handling of EO has inherent risk and it is impossible to eliminate risk where EO is to be employed. Risk can be tolerated if the principle of maintaining risk at a level that is ALARP is applied whilst taking into consideration the financial and operational constraints of Defence and the perception of the public. Application of the ALARP principle ensures compliance with Occupational Health and Safety (Commonwealth Employment) Act 1991, Section 16 (1).

3.9 **ERA review.** An ERA must be reviewed every two years or when circumstances surrounding the site change or there is a significant change in assumptions made during the ERA process. An ERA in support of a SQF must be reviewed every five years or when the licence is reviewed whichever is sooner.

3.10 If circumstances surrounding an ERA change significantly to affect the outcome of the ERA a review of the ERA must be undertaken.

3.11 **Training.** Staff undertaking ERA for EO activities are required to be trained and competent in Safety Risk Management (SRM).

3.12 **Siting Small Quantity Facilities.** Establishment, siting and installation of SQF must be closely coordinated with

a. The Licensing Authority (LA); and

b. The responsible security authority.

3.13 **Support.** The DOS is available to provide interpretation of the policy contained within this chapter. Any expenses incurred in implementing this policy, including training and software application updates will the responsibility of the Licensing Authority.

Responsibilities

3.14 ERA for the Department of Defence is to be conducted by suitably qualified and experienced staff in Defence Science and Technology Group (DSTG), Joint Operations Command, or the Explosive Ordnance Branch who are independent of the local management of the facility.

3.15 The LA is responsible for;

a. Issuing an ELL in accordance with the requirement of this regulation.

b. Training and authorising staff to conduct ERA for EO activities.

3.16 The Officer-in-Charge of a unit is responsible for authorising SQF for use.

Procedures

3.17 Procedures used to implement the requirements of this regulation are;

a. Procedure 1 – Qualitative and Semi-Quantitative Explosives Risk Assessment Process

b. Procedure 2 – Quantitative Explosives Risk Assessment Process

PROCEDURE 1 - QUALITATIVE AND SEMI-QUANTITATIVE EXPLOSIVES RISK ASSESSMENT PROCESS

Introduction

1.1 Explosives Risk Management (ERM) policy outlined in Regulation 5.3 provides a framework for identifying, prioritising and managing risk related to the licensing and storage of Explosive Ordnance (EO) within the Australian Department of Defence.

1.2 The Explosives Risk Assessment (ERA) process is to help the Licensing Authority determine if a licence can be issued, or if mitigation action is necessary before issuing the licence, or is a higher authority is required to authorise a licence. The ERA process is systematically conducted using the following stages:

a. Site/facility details (data collection);

b. Hazard identification and likelihood rating;

c. Consequence analysis;

d. Consequence rating;

e. Risk analysis; and

f. Risk evaluation.

Site Details

1.3 Site details to be recorded, as part of the ERA set the context for the ERA at a local level. Specific details regarding the site are to be categorised into Administrative Details and Risk Assessment Details. Administrative details provide an audit trail of information in the following categories;

a. Site Name.

b. Potential Explosion Site Identification Number or Name.

c. ERA Date.

d. The Hazard Division/s (HD) of all EO stored in the facility.

1.4 Risk assessment details include;

a. Any assumptions made prior to the risk assessment being undertaken. Assumptions must be stated to ensure the Licensing Authority or higher authority is aware of the circumstances and limitations of the assessment.

b. Construction details of the facility where EO will be stored.

c. Potential Explosion Site (PES) and Exposed Site (ES) details.

d. Valuable asset details.

Hazard Identification and Likelihood Rating

1.5 The hazard[1] identification stage involves identifying hazardous events that could occur based on the presence of a PES. For storage or handling of EO the primary hazard is usually its accidental or unintended initiation. Whether during storage, transport or an operation, certain mechanisms are known to initiate explosives. These mechanisms have been categorised into six Hazard Descriptions and are listed in Table 1–1. The hazard identification process involves consideration of each of the mechanisms relative to the PES where the ERA is being conducted. A thorough assessment of the PES should be made to consider both internal and external effects or processes that may contribute to the presence of any of the hazards described in Table 1–1. Key words are derived from the United Nations (UN) *UN Recommendations on the Transport of Dangerous Goods – Model Regulations*, ST/SG/AC.10/1 (as revised) (Orange Book) and are provided as guidance for the assessment of each hazard.

Hazard Checklist	
Hazard Description	**Guidance**
Impact/Stress/Friction/ Fragment	Bending, Drop (packaged), Drop (unpackaged), Lifting, Loose Cargo – Bounce, Rough Handling, Para Drop, Bump, Shock, Drop Topple and Roll Impact, Shock, Stacking, Tiedown, Vibration and Combined Environments, High Pressure, Low Pressure.
Fire/Thermal Energy	Fast Heating, Slow Heating, Altitude, Temperature, Humidity, High Temperature, Icing/Frosting, Low Temperature.
Static/Electrical Charge	Electrostatic Discharge, Lightning.
Blast/Overpressure	Reaction of and Adjacent Munition.
Chemical Reaction	Acid Atmosphere (Corrosion Acid, Acid Rain), Contaminating Fuild, Rain, Water Ingress, Immersion, Sealing.
Radio Frequency (RF) Radiation	Rad Haz EMC.

Table 1–1: Hazard Checklist

1.6 Once the hazards particular to the PES have been identified a hazard likelihood rating is applied to each hazard described in Table 1–1. The hazard likelihood is a qualitative description of the probability of the hazard occurring. The hazard likelihood ratings, to be applied against each of the hazards from the Hazard Check list, are contained in Table 1–2 with a brief description to aid the rating.

Hazard Likelihood Table	
Likelihood Rating	**Likelihood Description**
Almost Certain (A)	Particular hazard occurs frequently or is expected to occur in most circumstances.
Likely (B)	Particular hazard occurs several times or will occur in most circumstances.
Possible (C)	Particular hazard will or could occur.
Unlikely (D)	Particular hazard is not likely to occur.
Rare (E)	Particular hazard is so unlikely it can be assumed it will never occur or will only occur in exceptional circumstances.

Table 1–2: Hazard Likelihood Table

[1] For the purpose of this chapter the term 'hazard' describes hazards presented to the item of EO that may cause it to initiate. In the context of the United Nations (reference the term 'hazard' describes the hazards presented by the item of EO once initiated hence they are divided into Hazard Divisions (HD). To eliminate confusion the process defined in this chapter, the Consequence Division is based on the UN Hazard Division for classification of EO initiation consequences.

Consequence Categories and Ratings

1.7 For the purpose of ERA, the effects, or consequences of the initiation of an item of EO are divided into distinct categories based on the Hazard Division/s[2] (HD) of the item/s of EO. The consequence categories are:

a. Blast (Overpressure),

b. Primary Fragments (Weapon Fragments),

c. Secondary Fragments (Debris),

d. Thermal Radiation (Fire),

e. Ground Shock and Cratering, and

f. Toxicity.

1.8 Depending on the net explosive quantity (NEQ) and HD of EO to be stored in the facility, certain consequences must be considered in the risk assessment. Table 1–3 demonstrates that the HD of EO determines which consequences must be considered in the Consequence Analysis stage of the ERA. For example, all EO with HD 1.1 has the consequence of Blast to both personnel and infrastructure therefore Blast must be considered as a consequence when conducting an ERA for a facility. Table 1–3 illustrates that Secondary Fragmentation and Fire must also be considered for HD 1.1.

	Consequences		
Hazard Division	**Blast (Overpressure)**	**Secondary Fragments**	**Fire**
1.1	✔	✔	✔
1.2	✔	✔	✔
1.3		✔	✔
1.4			✔
1.5	✔	✔	✔
1.6		✔	✔

Table 1–3: Mandatory Consequences based on United Nations Hazard Division

1.9 Primary fragments must be considered as a consequence when explosives are cased or the munitions contain preformed fragments.

1.10 Once the consequences applicable to the ES are defined, a consequence analysis is to be conducted for each applicable consequence. Parameters that may be calculated are for each consequence are contained in Table 1–4.

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[2] 'Hazard Division' refers to HD as defined in the Glossary of Terms.

Consequence	Consequence Analysis
Blast (Overpressure)	Incident Overpressure Impulse
Primary Fragments	Nominal Fragment Weight Initial Fragment Velocity Fragment Striking Velocity
Secondary Fragments	Consequence analysis made with reference to blast calculations
Thermal Radiation	Maximum Fireball Radius (above ground and ground level) Fireball Duration
Toxicity	Acute and Chronic Exposure

Table 1–4: Consequence Analysis to be made per Consequence

1.11 Using calculations or references made in the consequence analysis, the assessor is to determine the extent of injury to any personnel or infrastructure at the ES. Based on the determined extent of injury a qualitative consequence rating is to be applied from the consequence rating table shown at Table 1–5.

1.12 When allocating a consequence rating where both personnel and asset (or platform) at the ES will suffer the effects of the EO initiation, the most severe rating is to be applied. For example, if the consequence of primary fragments is considered in an assessment and both personnel and infrastructure are being considered. The consequence to the infrastructure, based on Table 1-6, is determined as 'Major (2)', and the consequence rating for personnel is determined as 'Catastrophic (1)'. The rating applied for the scenario will be the most severe of the two, therefore the rating of 'Catastrophic (1)' will be applied to the consequence 'Primary fragments' for that particular assessment.

Consequence Rating Table		
Consequence Rating	**To Personnel**	**To Asset**
Catastrophic (1)	Multiple Fatalities	Loss of Asset
Major (2)	Single Fatality, Multiple Casualties. Debilitating Injuries	Severe Damage to Asset
Moderate (3)	Injury involving Hospitalisation but not Debilitating Injuries	Significant Damage to Asset
Minor (4)	Injury requiring Medical Treatment	Minor Damage to Asset
Insignificant (5)	Injury requiring First Aid	No loss of Asset

Table 1–5: Consequence Rating Table

Risk Analysis

1.13 Application of individual likelihood ratings against each consequence rating in Table 1–6 to the risk matrix determines the range of risks presented by the PES.

Consequence Rating					
Likelihood Rating	**Catastrophic (1)**	**Major (2)**	**Moderate (3)**	**Minor (4)**	**Insignificant (5)**
Almost Certain (A)	Extreme 1	Extreme 3	Extreme 8	High 11	High 16
Likely (B)	Extreme 2	Extreme 5	High 9	High 15	Medium 20
Possible (C)	Extreme 4	Extreme 7	High 12	Medium 18	Low 23
Unlikely (D)	Extreme 6	High 10	Medium 17	Low 21	Low 24
Rare (E)	High 13	High 14	Medium 19	Low 22	Low 25

Table 1–6: Explosives Risk Assessment Risk Matrix

1.14 The risk matrix is used to determine the risk level and the risk index. The risk level is represented as a qualitative term ranging from 'Extreme' through 'High and 'Medium', to 'Low' risk and the risk index, represented by a numerical designator, provides a more detailed analysis of the risk presented by the PES. For example Extreme Risk with a risk index of 1 is more severe than Extreme risk with a risk index of 8. The risk index aids prioritisation of risk for risk evaluation and enables a decision maker to readily review what likelihood and consequence ratings were applied in the assessment.

1.15 The risk levels and indices that have been determined for individual hazard description relative to each consequence rating can be expressed in a tabular format therefore presenting the risk presented by a PES in a readily assessable format. An example risk analysis is presented in Table 1–7. The example clearly demonstrates that the hazard 'Static/ Electrical charge' combined with the consequence 'Primary fragmentation' leads to extreme risk, hence mitigation methods would be concentrated on lowering the rating for either the consequence or likelihood or both.

		EXPLOSIVE RISK ANALYSIS					
		Consequence Division					
		Blast (Overpressure)	Primary Fragments (Weapon)	Secondary Fragments (Debris)	Thermal Radiation (Fire)	Ground Shock and Cratering	Toxicity
Hazard Description	**Rating**	Minor (4)	Major (2)	Insignificant (5)	Insignificant (5)	Insignificant (5)	Insignificant (5)
Impact, Stress, Friction, Fragment	Rare (E)	Low 22	High 14	Low 25	Low 25	Low 25	Low 25
Fire, Thermal Energy	Unlikely (D)	Low 21	High 10	Low 24	Low 24	Low 24	Low 24
Static, Electrical Charge	Possible (C)	Medium 18	Extreme 7	Low 23	Low 23	Low 23	Low 23
Blast (Overpressure)	Rare (E)	Low 22	High 14	Low 25	Low 25	Low 25	Low 25
Chemical Reaction	Rare (E)	Low 22	High 14	Low 25	Low 25	Low 25	Low 25
Radio Frequency (RF) Radiation	Rare (E)	Low 22	High 14	Low 25	Low 25	Low 25	Low 25

Table 1–7: Example presentation of Risk Levels

Risk Mitigation

1.16 Risk mitigation for ERA is the selection of appropriate options for treating risk. As defined in AS/NZS ISO 31000:2009 – *Risk Management*, risk can be treated in 2 separate ways:

a. **Risk Avoidance.** Risk presented by a PES can be avoided completely by not issuing a licence or authorising an activity.

b. **Risk Mitigation.** Either reducing the likelihood of EO being exposed to hazardous environments, and/or reducing the consequences of an event can mitigate risk.

1.17 Once risk mitigation methods are identified and applied at the PES or ES, their effect on likelihood and/or consequence is documented. The initial likelihood and/or consequence rating/s applied in the risk assessment may be are revised to consider the effects of mitigation. The residual risk presented by the PES to the ES is then evaluated against the risk criteria.

Risk Evaluation

1.18 The risk index determined in the risk analysis stage is used to prioritise all risks identified at the ES and the risk level is applied against the risk criteria to determine the risk management action. Table 1–8 contains risk criteria for issuing a licence based on ERA. The Licensing Authority (LA) referred to in Table 1–8 is consistent with the LA appointments detailed in Regulation 5.2 — 'Licensing of explosive ordnance facilities'.

Risk Level: Extreme	**Risk Index: 1 - 8**
Incident likelihood varies from unlikely to almost certain. EO safety measures or evidence supporting EO safety measures, or unsafe / undocumented practices may contribute to the risk. The likelihood rating combined with the consequences to personnel, which range from injury involving hospitalisation to multiple fatalities, leads to extreme risk. **Risk Management Action:** • To issue an explosive licence for an extreme risk PES the Licensing Authority must adhere to the Deviation application process detailed in Regulation 1.2 — Deviations from Mandatory Explosives Safety Requirements.	
Risk Level: High	**Risk Index: 9 - 16**
Incident likelihood varies depending on evidence supporting EO safety measures or practices and the consequences to personnel range from injury requiring first aid to multiple fatalities. The risk index provides guidance on the actual likelihood and consequence surrounding the risk. **Risk Management Action:** • To issue an explosive limit licence for a high risk PES the Licensing Authority must adhere to the Deviation application process detailed in Regulation 1.2 of this manual.	
Risk Level: Medium	**Risk Index: 17 - 20**
Incident likelihood ranges from likely to rare and the consequences to personnel range from injury involving hospitalisation (not debilitating injuries) to injury requiring first aid. **Risk Management Action:** • The Licensing Authority may authorise a medium risk explosive limit licence for a maximum duration of 1 year.	
Risk Level: Low	**Risk Index: 21 - 25**
Incident likelihood ranges from possible to unlikely and the consequences to personnel range from injury requiring medical treatment to injury requiring first aid. **Risk Management Action:** • Licensing Authority may authorise a low risk explosive limit licence for a maximum duration of 5 years.	

Table 1–8: Qualitative and Semi-Quantitative Risk Criteria

PROCEDURE 2 - QUANTITATIVE EXPLOSIVES RISK ASSESSMENT PROCESS

Introduction

2.1 Quantitative Explosive Risk Assessment (QERA) calculates the risk from a Potential Explosion Site (PES) to personnel situated at an adjacent Exposed Site (ES). A QERA is based on experimental and historical data and can be considered a detailed investigation of a potentially hazardous situation. Conducting a QERA is a complex task that must be undertaken and reviewed by qualified and experienced personnel.

2.2 Nations including the USA and UK are currently using quantitative risk assessment for authorising explosive activities to accompany quantity distance licenses or for deviation applications. Within the Australian environment statistical and historical data regarding explosive incidents is limited. It is mandatory that data available to conduct a QERA is accurate and statistically valid so error margins for results applied to risk criteria remain within the margins of the criteria.

2.3 The QERA process can be broken into the following stages:

a. Hazard identification,

b. Deriving the event frequency,

c. Performing a consequence analysis,

d. Conducting an exposure analysis,

e. Calculating the risk, and

f. Performing a risk appraisal.

These stages are briefly outlined in the following paragraphs.

Hazard Identification

2.4 The hazard identification process involves identifying the hazardous events that could in principle occur. For the purpose of a QERA, the primary hazard is accidental initiation of EO, whether during storage, or a process operation, or transport on site. In addition, there are ‘external’ hazards arising off-site, such as the possibility of lightning strikes, aircraft crashes onto the site, or knock-on effects arising from the transport of hazardous materials on nearby roads. The identification process must be comprehensive as any event not considered can result in an inaccurate assessment. Table 2–1 contains hazards applicable to EO in conjunction with guidance to facilitate hazard identification.

Event Frequency Determination

2.5 The event frequency (Fe) is a measure of likelihood and takes into consideration factors that can trigger an explosion. Each identified hazard arising from the hazard identification process is assessed and an event frequency or probability is determined. Two methods are available to determine event frequency:

a. ‘Level 1’ analysis and is generally regarded as conservative in its outcome and is the simplest method available to estimate event frequencies. It relies on historical data supplemented by independent expert opinion.

b. ‘Level 2’ analysis is a more accurate and complex approach to determine event frequencies. Level 2 analysis involves the use of techniques, such as event tree analysis or fault failure analysis, to derive accidental initiation frequencies for a particular identified event.

Where many hazards are to be considered at a PES the event frequency is calculated using the following equation:

$$\mathbf{F_e = F_1 + F_2 + F_n}$$

Where: $\mathbf{F_e}$ = Event frequency (yr^{1})

$\mathbf{F_1}$ = Event frequency of hazard type 1 (yr^{1})

$\mathbf{F_2}$ = Event frequency of hazard type 2 (yr^{1})

$\mathbf{F_n}$ = Event frequency of last hazard type considered (yr^{1})

Consequence Analysis

2.6 Consequence analysis involves determining the most severe outcomes of an identified hazard or threat. In QERA, consequence analysis typical examines the primary effects that can occur following an accidental initiation of EO, termed consequence divisions. A summary of explosion effects and their consequence importance are shown in Table 2–1.

Consequence Division	**Consequence Analysis**
Blast (Overpressure)	• Incident Overpressure • Impulse
Primary Fragmentation (Weapon Fragments)	• Nominal Fragment Weight • Initial Fragment Velocity • Fragment Striking Velocity
Secondary Fragmentation (Debris)	• Nominal Fragment Weight • Initial Fragment Velocity • Fragment Striking Velocity
Thermal Radiation	• Maximum fireball diameter (above ground and ground level) • Fireball duration
Ground-shock and Cratering	• Ground shock cratering effects are generally not calculated when considering above-ground EO activities as their contributions to fatalities are insignificant when compared with the other four consequence divisions.

Table 2–1: Consequence Divisions

2.7 Technical Papers and Computer models[1] and consequence tables are available which give estimates of the conditional fatality probabilities arising from each of these effects. The sum of all the individual consequence probabilities is termed the fatality probability (Pf) as shown by the following equation:

$$\mathbf{P_f = P_{Blast} + P_{Fragmentation} + P_{Debris} + P_{Thermal}}$$

Where: $\mathbf{P_{Blast}}$ = Fatality probability resulting from blast effects.

$\mathbf{P_{Fragmentation}}$ = Fatality probability resulting from primary fragment effects.

$\mathbf{P_{Debris}}$ = Fatality probability resulting from secondary fragment effects.

$\mathbf{P_{Thermal}}$ = Fatality probability resulting from thermal radiation effects

[1] The United States Department of Defence Explosive Safety Board (DDESB) website (see http://www.ddesb.pentagon.mil/techpapers.html) provides technical papers for consequence determination. The software tools SAFER, and Blast Effects Computer are described here in detail.

NOTE

Fatality probability is statistical and therefore has a maximum value of 1.

2.8 It is essential to realise that consequence analysis, as applied in QERA, only considers primary fatalities (fatalities resulting directly from the consequences of the explosion). Secondary fatalities, those fatalities resulting from subsequent events or severe injuries that later result in death are not reflected in consequence analysis processes. Nevertheless, a subjective assessment of secondary fatalities must be considered during the risk appraisal process to provide a complete appreciation of the likely numbers of fatalities.

Exposure Analysis

2.9 The aim of an exposure analysis is to ascertain 'how many' and 'how long' people in the surrounding area are exposed to any potential explosion effects. An exposure analysis outcome is termed 'fractional exposure' and is expressed on an annual basis for a particular individual or group of individuals. Although fractional exposure is a subjective assessment in terms of time, effort and care must be taken in population surveys to identify all those individuals who reside and/or likely to visit in the area during the year. The survey must also include information relating to length of exposure at a particular identified site and percentage of time these individuals are inside/outside the site.

2.10 For the purposes of QERA, three categories of population have been assigned for exposure analysis calculations, these are:

a. **Residents.** A group of individuals who are considered to be permanently present at a location are classified as 'residents'. This classification is mainly directed at residential areas where it is assumed that residents are likely to be exposed to the risk on a full-time (24 hour) basis.

b. **Workers.** A group of individuals who are considered semi-transitory in nature are classified as 'workers'. This group would generally include people who are employed at a particular location for less than 24 hours each day. Typically, this group of individuals would include staff employed at their place of work.

c. **Transients.** Although, this group of individuals are similar in nature to workers, it is principally directed at people who can be considered as visitors to the surrounding area. Typical examples would be travellers passing through the area or spectators/players at a nearby sporting field.

2.11 Generally, the potential hazards from a Potential Explosion Sites (PES) are considered to be present all the time, as in the case when considering a licensed EO storehouse. Thus the fractional exposure in these cases is limited to determining exposure periods for people in the surrounding area. However, there will be instances when the PES need not be considered active all year long (ie aircraft ordnance loading aprons or short-term EO handling operations). For these special situations, the period during which the PES is active should be reflected in the fractional exposure value.

Calculating Risk

2.12 The risk calculation stage of the QERA process numerically connects the outcome determined from the frequency, consequence and exposure analysis stages. Risk calculation outcomes are divided into three separate dimensions.

2.13 **Potential risk (PR).** PR is concerned with the personal safety of any individual at a particular ES therefore exposure is not considered in the risk equation. PR can be used to define a risk zone or contour irrespective of people being there or not and provides a worst case scenario for any single individual. PR is calculated as follows:

PR = Event Frequency X Fatality Probability

$$= F_e \times P_f$$

Where: F_e = Event Frequency (yr^1)

P_f = Fatality Probability

2.14 Individual risk (IR). IR is risk related to a defined individual where their exposure to the site is factored into the risk equation. IR is determined as follows:

$$\mathbf{IR} = \textbf{Event Frequency} \times \textbf{Fatality Probability} \times \textbf{Fractional Exposure}$$

$$= \mathbf{F_e} \times \mathbf{P_f} \times \mathbf{(E_{Individual} \times E_{PES})}$$

Where: F_e = Event Frequency (yr^1)

P_f = Fatality Probability

$E_{Individual}$ = Exposure period for the particular individual at an ES expressed as a fraction of a year

E_{PES} = Period time the potential hazard present at the PES expressed as a fraction of a year

2.15 Societal Risk (SR). SR reflects the likelihood of accidents involving multiple casualties and specifically indicates the relationship between event frequency and the number of fatalities. SR is often shown on an Accident Frequency vs No of Fatalities (F–N) curve. The F–N curves plot the frequency of events with casualty numbers greater than or equal to N against N itself. In order to calculate SR, the number of fatalities in the surrounding area must be assessed for all possible population distributions and explosion scenarios, together with the respective frequency of occurrence. Simply, SR is expressed as follows:

$$\mathbf{SR} = \textbf{Accident Frequency} \ \textbf{vs} \ \textbf{No of Fatalities (Max)}$$

$$= \mathbf{F_a} \ \textbf{vs} \ \mathbf{N_{Fatalities}}$$

These two parameters are calculated as follows:

a. **Number of fatalities.** The number of fatalities that would occur in the event of an explosion depends directly on the population distribution at the time of the explosion and fatality probability. For a single ES, the number of fatalities within a person type, if they are at the site, will be:

$$\textbf{No Fatalities (Type A)} = \textbf{No of People Considered} \times \textbf{Fatality Probability}$$

$$\mathbf{N_{F(A)}} = \mathbf{N_T\, f_{PT}} \times \mathbf{P_f}$$

Where: $N_{F(A)}$ = Number of fatalities of people who are Type A

N_T = Total number of people at the site at the time

f_{PT} = Fraction of people at the ES who are of Type A

P_f = Fatality Probability (sum of all consequences)

In addition, the number of fatalities is also broken down into two components; Likely Number and Maximum Number. The ‘maximum number’ is estimated simply by the fatality probability multiplied by the people (population) at the ES. Whereas, the ‘likely number’ of fatalities is estimated multiplying the fatality probability by the population at the ES and actual exposure at the sites as shown below:

$$\textbf{No of Fatalities (Max)} = \sum(\mathbf{N_F})$$

$$\textbf{No of Fatalities (Likely)} = \sum(N_F \times E)$$

Where: N_F = Total number of fatalities expected at the site

E = Actual exposure period for people at the site

b. **Accident Frequency.** In determining the frequency of achieving the maximum number of fatalities, the event frequency must be multiplied by the fractional exposure between both sites. The resulting frequency is termed the accident frequency (F_a) is used in the development of the F–N plot for SR.

Accident Frequency = Event Frequency X Fractional Exposure

$$F_a = F_e \times (E_{ES} \times E_{PES})$$

2.16 Evaluating the Risk. The final phase of a QERA is the risk appraisal stage. Evaluating the risk resulting calculated in a QERA against predefined risk criteria is a method for determining a risk management action, similar to the approach outlined in Procedure 1. For example, *Risk Criteria for Land Use Safety Planning, Hazardous Industry Planning Advisory Paper No. 4 Department of Urban Affairs and Planning, Sydney 1992* details that the department, has adopted a fatality risk level of 1×10^{-6} per year as the limit for risk acceptability for residential area exposure. Risk criteria are adjusted by the department for industrial areas depending on the use of the land as defined in Table 2–2.

Land Use	**Risk Criteria**
Hospitals, Schools, Child Care Facilities, Old Age Housing Developments	0.5×10^{-6}
Residential developments and places of continual occupancy such as hotels and tourist resorts	1×10^{-6}
Commercial developments including offices, retail centres, warehouses with showrooms, restaurants and entertainment centres	5×10^{-6}
Sporting complexes and active open space areas	10×10^{-6}
Individual fatality risk level for industrial sites	50×10^{-6}

Table 2–2: Quantitative Risk Assessment Criteria for Individual Fatality Risk[2]

In addition to the figures presented in Table 2–2, *Risk Criteria for Land Use Safety Planning, Hazardous Industry Planning Advisory Paper No. 4 Department of Urban Affairs and Planning, Sydney 1992* provides injury risk level and suggests that an incident explosion overpressure at residential areas should not exceed 7kPa (1 psi) at frequencies of more that 50×10^{-6} per year. Further examples of quantitative risk criteria can be reviewed in *Risk Criteria for Land Use Safety Planning, Hazardous Industry Planning Advisory Paper No. 4 Department of Urban Affairs and Planning, Sydney 1992* and *United Kingdom (UK) Health and Safety Executive (HSE): Risk Criteria for Land-use Planning in the Vicinity of Major Hazards, HMSO, 1989. IBSN:0 11 8854917*.

2.17 The decision to approve or not approve an EO activity must not be based purely on the numeric outcome alone because the purpose of a QERA is to provide a sensitivity analysis of specific areas in terms of event frequency, consequences, and exposure that have the potential to effect assessed risk levels. A review process should be established to monitor changes at the site that could also instigate a requirement for a review of the QERA.

2.18 Approving authorities must be made fully aware of the limitations of the QERA methodology and the assumptions made and uncertainties inherent in the risk assessment.

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[2] Sourced from *Risk Criteria for Land Use Safety Planning, Hazardous Industry Planning Advisory Paper No. 4 Department of Urban Affairs and Planning, Sydney 1992*

REGULATION 5.4 - QUANTITY DISTANCES

General Overview

4.1 It is impracticable to prescribe distances which would be safe distances in the true sense, i.e. which would guarantee absolute immunity from propagation, damage or injury in the event of an accidental explosion. An attempt has therefore been made in the recommendations in this manual to allow for the probability of an accident and the severity of the resulting damage or injury. The separation distances (quantity distances) between a potential explosion site and an exposed site recommended therefore represent a compromise deemed tolerable between absolute safety and practical considerations including costs and operational requirements.

Requirements

4.2 The Department of Defence will apply the Quantity Distance (QD) contained in the Allied Ammunition Storage and Transport Publication 1 (AASTP-1) Manual of NATO Safety Principles for the Storage of Military Ammunition and Explosives[1], as modified by the Explosives Storage and Transport Committee, for the storage of Defence Explosive Ordnance (EO) where the NEQ is greater than 50 kg.

4.3 Where QD cannot be met the requirements of Regulation 1.2 – Deviations from Mandatory Explosives Safety Requirements are to be implemented.

4.4 QD are applicable to;

a. Above-ground storage of EO (annex A);

b. Above-ground storage for open stacks and buffered storage (annex B);

c. The separation of Petrol, Oil and Lubricants (POL) from EO within military installations (annex C);

d. Missile installations (annex D);

e. Basic load EO holding areas (annex E);

f. Airfields (annex F);

g. The transfer of EO in naval ports (annex G);

h. Field storage (annex H); and

i. Underground storage of EO.

4.5 QD calculations for Underground storage are to be calculated in accordance with the requirements of AASTP-1 Part III Underground Explosives Storage dated April 2010.

Responsibilities

4.6 QD Rules are to be applied by the Defence Licensing Authorities.

Procedures

4.7 Procedures on application of QD rules are provided in Procedure 1 – Application of Quantity Distances.

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[1] The continued use of AASTP 1: 2010 is under review

Annexes:

ANNEX A

QUANTITY DISTANCES FOR ABOVE-GROUND STORAGE

General

1. On the basis of assessment of the effects of such an event, eg blast and fragment radii, and predictions as to which specified levels of risk obtain in terms of injury or damage, tables of Net Explosives Quantity (NEQ) and associated recommended distances have been developed. These tables are known as Quantity Distance (QD) Tables and, together with other criteria for their use, form the foundation for explosives licensing of Potential Explosion Sites (PES) within Defence.

2. Any building, stack or vehicle (road or rail) permitted to contain EO presents a potential risk of explosion or fire. Such sites, designated PES, present a hazard to other EO storage or handling facilities as well as to people and property. PES therefore, are to be sited at calculated distances from other EO facilities, traffic ways, installations and dwellings or other places frequented by persons (all designated Exposed Sites (ES), both within and outside EO storage areas, so as to ensure the minimum reasonable practicable risk to life and property. The distance from a PES to an ES is usually a function of the maximum NEQ permitted at the PES and is designated the QD. QD are generated by distance functions subject, in certain cases, to fixed minimum distances. QD are applied to all PES and are fundamentally dependent upon the Hazard Division (HD) of the EO being stored. QD are tabulated in appendix 1.

Requirements

3. Net Explosive Quantity. This regulation provides the principles and criteria applicable to the above-ground storage and handling of Defence Explosive Ordnance (EO) and presents tables of Quantity Distances (QD) for quantities of at least 50 kg Net Explosives Quantity (NEQ) per explosives site.

4. Hazard Division 1.4. Separation distances from EO of HD 1.4 are not a function of the NEQ. Stacks or vulnerable buildings should normally be separated by 25 m to prevent ignition by radiant heat, with a minimum of 10 m for fire resistant PES.

Basis of quantity distances

5. The QD are based on an extensive series of trials and a careful analysis of all available data on accidental explosions in different countries. However, QD are subject to uncertainty owing to the variability of explosions. These QD are generated by distance functions subject, in certain cases, to fixed minimum or maximum distances. The fixed values are independent of the NEQ because they are based on the projection hazard from individual rounds or operational factors. As regards the rounding of values of QD, see appendix 1, paragraph 3. Criteria and formulae for QD are given in appendix 2.

Kinds of quantity distances

6. There are two kinds of QD for each HD: inside Quantity Distance (IQD) and Outside Quantity Distance (OQD):

a. **IQD.** There are two types of IQD for each HD:

(1) Inter-Magazine Distances (IMD) which are applied between PES and storage sites containing EO; and

(2) Process Building Distances (PBD) which are applied between a PES and a facility where EO is being worked on.

b. **OQD.** There are three types of OQD for each HD:

(1) Public Traffic Route Distances (PTRD) which are applied between PES and recognised Public Traffic Routes (PTR).

(2) Vulnerable Building Distances (VBD) which are applied between a PES and buildings of vulnerable construction.

(3) Inhabited Building Distances (IBD) which are applied between PES and buildings or sites where members of the general public or persons not involved in EO handling, either work, live or congregate.

Quantity distances for Hazard Division 1.1

7. Appendix 1, table 1A1–1 gives selected IQD and OQD for EO of HD 1.1. The IMD given should not generally be used for packages of primary explosives or other sensitive explosive substances, eg some blasting gelatines or pyrotechnic compositions which will require individual assessment to ascertain the QD required.

Quantity distances for Hazard Division 1.2

8. **General.** Appendix 1, table 1A1–2 gives IQD and OQD for EO of HD 1.2 but, before appropriate QD can be selected, there are two factors to be considered.

a. The first is the range of fragments and lobbed EO that may be projected from a PES in an explosive event.

b. The second is the total number of such projections likely to hazard an Exposed Site (ES). If comprehensive data is available for a particular item, then the QD for HD 1.2, which are based on trials with individual rounds considered to be representative, may be replaced by this more appropriate data taking account of the vulnerability of EO and buildings at the ES under consideration, see Regulation 6.1.

9. **Range of fragments and lobbed EO.** For HD 1.2 EO, the range of fragments and lobbed EO can be classified as follows:

a. **Items classified HD 1.2.1.** It is impractical to specify QD that will allow for the maximum possible flight ranges of propulsive items but the likely range of packaged items, if involved in an accident during storage, is typical of this part of HD 1.2. Munitions that explode during an accident will rarely detonate in their design mode. In a fire situation, explosive fillings may melt and expand, breaching their casings and burn, possibly to detonation. These events may involve all or only a small part of the filling dependant upon how much filling has escaped through the breach in the casing. The fragments produced by such reactions are totally different to those produced in the design mode. The casing splits open to producing large (two–three kg for a 105 mm shell) but comparatively few fragments with velocities of 100–500 ms^{-1}. These larger fragments are likely to be projected further than the smaller fragments from the full detonation of similar munitions in a HD 1.1 reaction. Quantities of unexploded items, sub-assemblies or sub-munitions may also projected to considerable distances and may be, due to thermal or mechanical damage, be more hazardous than in their pristine state. Data on individual item characteristics obtained from tests and accidental explosions may be used to determine the validity of including specific items in this more hazardous category or having it included in the less hazardous HD 1.2.2 category.

b. **Items classified HD 1.2.2.** The less hazardous part of HD 1.2 comprises those munitions that contain a high explosive charge and may also contain a propelling or pyrotechnic charge. These munitions will have an individual NEQ equal to or less than 0.73kg. It will also typically include ammunition that does not include high explosive and will include pyrotechnic rounds and articles and rounds with inert projectiles. Tests show that items of HD 1.2.2 produce fragments and lobbed EO with a range significantly greater than that of EO in HD 1.4 but less than those of HD 1.2.1. This sub-division HD 1.2.2 was sometimes previously known as 1.2*, but use of this term has been discontinued.

10. Subdivisions for storage. The HD 1.2 subdivisions 1.2.1 and 1.2.2 are for storage purposes only and it is stressed that it is not a recognised code in the United Nations (UN) system of classification and must not appear on package labelling. It is also important not to exaggerate the significance of the arbitrary 0.73kg NEQ criterion used above. It was based on a break point in the database supporting the QD relationships and tables, and the NEQ of the items trialled. If comprehensive data is available for a particular item, then the item may be placed in that category of HD 1.2 supported by the data and allocated the relevant QD. It may be necessary to take into account the vulnerability of items and the buildings in which they are stored at the ES under consideration.

11. Number of fragments and lobbed items at an ES. Following the initiation of an event in a PES there will be a delay before there are any violent events and projections. This delay will be highly dependent on the nature, dimensions and packaging of the items involved. For 40 mm HE rounds it can be as short as two or three minutes and for 105 mm HE rounds 15–20 minutes. Once items start to react the rate of reactions increases rapidly and then decreases more slowly. Reactions may still occur hours after the event. The ability of the PES structure to contain fragments and lobbed items will determine, both in time and density, the effects at the ES. For medium and lightly constructed PES where, at some stage, the walls and/or roofs will be destroyed, the modifying effect of the building on the fragmentation is not taken into account. In view of the difficulties in determining the effects of fragmentation in terms of time and quantity, fire fighting will, in general, be inadvisable. However, the installation of automatic fire suppression equipment could be invaluable from both the asset preservation and event containment perspective. Evacuation from PTR and beyond may be possible. However, the QD given in appendix 1 assume no amelioration from fire fighting or evacuation. They are based on the total fragmentation at the ES from the event at the PES.

12. Arrangements for firefighting. The levels of protection for HD 1.2 afforded by the IMD in appendix 1, table 1A1–2 are based on the fragment density at the ES for the total incident and the degree of protection afforded by the structure at the ES. It is assumed that an incident involving HD 1.2 cannot be properly curtailed by firefighting. It is considered unlikely that any significant attempts could be made to fight a fire involving HD 1.2 as it is anticipated that such efforts would have to be made from such a distance and from behind protective cover so as to make those efforts ineffective. Some storage areas are too remote from professional firefighting services and others lack suitable cover to protect firefighters fighting the fire. The levels of protection take into account the fact that the explosive ordnance area is endangered by firebrands, projections and lobbed ammunition which would most likely propagate fire or explosion if the QD were insufficient. The available firefighting effort should therefore, be directed at preventing the spread of fire and the subsequent propagation of explosions. Fuller recommendations are given in Regulation 4.7 Procedure 1 —'Fire Protection, Prevention and Firefighting Emergency Arrangements for Explosive Ordnance'.

13. Clean-up of area after an incident. The distances specified for HD 1.2 EO achieve the desired degree of protection against immediate hazards from an incident. Note must be taken however, that many HD 1.2 items lob excessive amounts of unexploded rounds, components, and subassemblies which will remain hazardous when they do not explode on impact. Such items may be more hazardous than in their original state because of damage to fuze safety devices or other features by heat and impact. Careful search of the area surrounding any incident involving HD 1.2 is required to detect and remove or destroy the remaining hazardous material. This search must be supervised by explosive ordnance disposal personnel or other qualified technicians who are able to evaluate the hazard expected. The magnitude of the clean-up problem is often underestimated. EO such as cluster bombs, can be expected to cause heavy contamination out to distances as great as the relevant IBD.

14. Situations requiring No QD. Where either the PES or the ES is an earth covered building or a building that can contain the effects generated in an accidental explosion of the HD 1.2 EO then, in general no QDs are necessary. The separation to other explosives storehouses, process buildings, public traffic routes or inhabited buildings will be dependent on constructional details, access for rescue and fire fighting personnel or other administrative arrangements. For public traffic routes and inhabited buildings consideration should be given to the use of fixed distances of 30 m for items of HD 1.2.2 or 60 m for HD 1.2.1. However, where there is an aperture such as a door in the PES and the ES has either an unprotected and undefined door facing the PES or offering no protection to its contents, then the QDs prescribed in appendix 1, table 1A1–2 column b are to be applied.

Quantity distances for Hazard Division 1.3

15. **General.** Appendix 1, tables 1A1–3 and 1A1–4 give IQD and OQD for EO of HD 1.3, but the selection of the appropriate QD requires separate consideration of two subdivisions of this HD for storage, namely propellants (Compatibility Group C) and other items (Compatibility Group G). Although many of the hazardous effects are common to both types, the dominant hazards used as the basis of certain QDs are different in the two cases, hence there are two tables. It is stressed that HD 1.3.3 and HD 1.3.4 are not recognised codes in the UN system of classification and are to be used only for storage purposes and must not appear on package labelling. A distinction is made between the more hazardous items (HD 1.3.3) and those of lesser hazard (HD 1.3.4).

16. **Items classified Hazard Division 1.3.3 producing a mass fire effect.** HD 1.3.3 consists of the more hazardous items of HD 1.3 and are more likely to be bulk packed gun propellants which produce a fireball with intense radiant heat, firebrands and some fragments. The firebrands may be only small glowing particles of packaging materials but sometimes there may be massive fiery chunks of burning propellant. The effect of quite normal winds may augment a calculated flame radius by 50 per cent. A building with marked asymmetry of construction, such as an igloo, or a building with protective roof and walls, but with one relatively weak wall or a door induces very directional effects from the flames and the projection or burning packages. These effects are particularly significant for storehouses and process buildings at the ES facing the directional jetting. If prompt attendance by a fire brigade is impossible, loss of such buildings and contents may occur. Wherever possible, a PES should always vent away from an ES otherwise an increased risk of propagation of fire exists.

17. **Items classified Hazard Division 1.3.4 not producing a mass fire effect.** HD 1.3.4 consists of the less hazardous items of HD 1.3 that produce a moderate fire with moderate projections and firebrands. The projections include fragments that are less hazardous than those which characterise HD 1.2 as described in paragraph 9. This sub-division was previously known as 1.3*, but use of this term has been discontinued.

Quantity distances for Hazard Division 1.4

18. Separation distances from EO of HD 1.4 are not a function of the NEQ. Stacks and buildings should be separated to prevent ignition by radiant heat, ie 25 m if the items are vulnerable to radiant heat, a lesser distance (10 m) if not prone to ignition by radiant heat, or separation distances as prescribed by fire regulations.

INTER-MAGAZINE DISTANCES

General

19. IMD are the minimum permissible distances between PES and storage sites containing EO. These distances are intended to provide specified degrees of protection to the EO at the ES. The degree of protection is highly dependent upon factors such as sensitiveness of explosives, type of explosives, type of packaging, and type and construction of building at the PES or the ES or both. In general the provision of stronger buildings allows the use of smaller QD for a given degree of protection, or achieves a better standard of protection at a given distance, especially in the case of a PES containing EO of HD 1.1 or 1.2.

20. The selection of the optimum combination of types of construction of the buildings, QD and the degree of protection involves a balance between the cost of construction, the availability and cost of land, and the value of the stocks of EO which might be rendered unserviceable at ES in the event of an EO incident at the PES. The HD and compatibility groups of the EO and the need for flexibility in the use of the sites should be taken into account.

21. Paragraphs 22–25 describe the levels of protection corresponding to common combinations of buildings or stacks and QD for each HD as a guide for decisions on the optimum solution. These levels of protection are incorporated in the IMD in appendix 1, tables 1A1–1 to 1A1–4. Some entries in the tables show only one level of protection owing to a lack of information at the present time. In a few cases it is not possible to predict the level of protection as it depends on the type of structure at the ES and sensitiveness of its contents. An indication of the full range of possibilities is given in Regulation 6.1.

Inter-magazine distances for Hazard Division 1.1

22. **Protection of stocks.** The observed damage to stocks at an ES from an accidental explosion varies widely and, although detailed prediction of such effects is outside the scope of this manual, a measure of guidance is given here. Since an igloo is designed to resist blast, primary fragments or secondary projections, the design ensures that the stocks survive and would be expected to generally remain serviceable. However, at D3–distances the ground shock may render unserviceable sensitive electrical and electronic components of guided missiles, etc. For open stacks and buildings, other than those covered with earth, a general assessment is that for distances less than D5–distances it is probable that, even though propagation may not have taken place, the stocks are likely to be unserviceable and covered by debris from the collapsed building. Stocks at D7– distances and greater are only likely to be serviceable if the building has not suffered serious structural damage although some structural damage at the D7–distances, dependent on the type of building, can be expected.

23. **Alternative levels of protection at an exposed site.** As described above, the igloo design affords extremely good protection to its contents. Weaker buildings and open stacks would not be expected to give such good protection although concrete structures are considered to be superior generally to brick from an ES point of view. The level of protection also depends on the vulnerability or robustness of the EO stored at the ES and the type of traversing used. The following paragraphs describe the three levels of protection which are incorporated in appendix 1, table 1A1–1 and which are intended to provide an adequate basis for the selection of a particular QD. Some entries in the table show only one level of protection due to lack of data. The three levels are:

a. **Level 1.** For level 1 protection there is virtually complete protection against practically instantaneous propagation of explosion by ground shock, blast, flame and high velocity projections. There are unlikely to be fires or subsequent explosions caused by these effects or by lobbed EO. The stocks are likely to be serviceable. However, ground shock may cause indirect damage and even explosions among especially vulnerable types of EO or in conditions of saturated soil. These exceptional circumstances require individual assessment rather than use of the QD in appendix 1.

b. **Level 2.** For level 2 protection there is a high degree of protection against practically instantaneous propagation of explosion by ground shock, blast, flame and high velocity projections. There are occasional fires or subsequent explosions caused by these effects or by lobbed EO. Most of the stocks are likely to be serviceable although some are covered by debris.

c. **Level 3.** For level 3 protection there is only a limited degree of protection against practically instantaneous propagation of explosion by ground shock, flame and high velocity projections. There are likely to be fires or subsequent explosions caused by these effects or by lobbed EO. The stocks are likely to be heavily damaged and rendered unserviceable; they are sometimes completely buried by debris. This level of protection is not recommended for new construction.

Inter-magazine distances for Hazard Division 1.2

24. The IMD for HD 1.2 relate essentially to three levels of protection of EO at an ES. These levels are:

a. **Level 1.** For level 1 protection there is virtually complete protection against immediate or subsequent fires and explosions caused by blast, flame, firebrands, projections and lobbed EO. The stocks are likely to remain serviceable.

b. **Level 2.** For level 2 protection there is a high degree of protection against immediate propagation of explosions caused by blast, flame, projections and lobbed ammunition. The larger the donor event the lower will be the degree of protection given, particularly when items of HD 1.2.1 are involved, propagation becoming more likely the longer the event continues. Local fire fighting measures may reduce stock loses. The use of this level of protection is penalised in appendix 1, table 1A1–2 by the imposition of D5 (for HD 1.2.2) and D6 (for HD 1.2.1) IMD between unprotected stacks of EO. It is likely that stocks at the ES will not survive as a result of the subsequent propagation.

c. **Level 3.** For level 3 protection there is only a limited degree of protection against immediate or subsequent propagation of explosions caused by blast, flame, projections and lobbed ammunition. The protection afforded may be minimal when the donor event involves large quantities of EO and continues for a prolonged period. Local fire fighting measures will be essential to the preservation of stock.

Inter-magazine distances for Hazard Division 1.3

25. The IMD for HD 1.3 relate essentially to two levels of protection of EO at an ES: These levels are:

a. **Level 1.** For level 1 protection there is virtually complete protection against immediate or subsequent fires among the contents of an ES by flame, radiant heat, firebrands, projections and lobbed EO. There may be ignition of combustible parts of the building but this is unlikely to spread to the contents even if it were not possible to provide prompt and effective firefighting services.

b. **Level 2.** For level 2 protection there is a high degree of protection against immediate propagation of fire to the contents of an ES by flame, radiant heat, firebrands, projections and lobbed EO. There is a considerable risk that one or more of these effects, especially lobbed EO, is likely to ignite the contents directly or as the result of ignition of combustible parts of the building unless effective firefighting is able to prevent such consequences.

PROCESS BUILDING DISTANCES

General

26. PBD are the minimum permissible distances between PES and process buildings (also known as explosive ordnance workshops). The distances are intended to provide a reasonable degree of immunity for personnel within the process building from effects such as blast, flame, radiant heat and projections caused by a nearby explosion. Light structures are likely to be severely damaged, if not completely destroyed. These distances also provide a high degree of protection against immediate or subsequent propagation of an explosion.

Process building distances for Hazard Division 1.1

27. For HD 1.1 the standard PBD should be the D10–distances prescribed in appendix 1, table 1A1–1. At these distances the major effects to be considered are the peak side-on overpressures, which are anticipated to be no greater than 20 kPa and debris, which is extremely difficult to quantify, but would be a very significant effect.

28. When siting and designing process buildings the following effects should be kept in mind amongst others. A person in a building designed to withstand the anticipated blast loading but without windows would be merely startled by the noise of the explosion at an adjacent site; whereas a person in a brick building with windows might suffer eardrum damage (threshold level of pressure for ear damage is 33 kPa) and might suffer indirect injuries through translation by blast and subsequent impact on hard objects or through collapse of the building.

29. **Separation of process buildings from storage sites.** The D10–distances in appendix 1, table 1A1–1 less than 270 m may not give protection to personnel in process buildings having light roofs from debris projected from the PES. If greater protection is required against projections than that provided by D10–distances, for example, to protect personnel and valuable test equipment, then the process building must be provided with a protective roof. If there is a possibility of a serious fragment hazard, then consideration is to be given to observing a minimum separation distance of 270 m between process buildings having light roofs and storage sites containing EO of HD 1.1 as is already required in certain circumstances.

Process building distances for Hazard Division 1.2

30. Debris and/or fragmentation hazards are considered to be dominant for HD 1.2 and the IBD is based on an appreciation of these hazards:

a. The PBD is generally determined as 36 per cent of the IBD.

b. However, where the PES is an earth covered building, or a building which can contain the effects generated in an accidental explosion, no QD are necessary to adjacent process buildings, although the separation distance between them will be dependent on construction criteria and access for rescue and fire-fighting personnel.

c. Where the PES is an earth covered building, or a building which can contain the effects generated in an accidental explosion, but has a door or other aperture in the direction of the ES, the PBD is determined as 36 per cent for the IBD.

d. Where the process building is protected by a traverse and has a protective roof, it is considered that the occupants are afforded a higher degree if protection. If the ES is either not traversed or does not have a protective roof the level of protection to occupants decreases. In the absence of any protective features to the ES, such as a traverse or a protective roof, the level or protection limited and such process buildings are to be sited at PTRD unless prompt and safe evacuation of personnel can be assured

Process building distances for Hazard Division 1.3

31. The PBD for HD 1.3 are as follows:

a. For the more hazardous EO of HD 1.3.3, the D2–distances prescribed in appendix 1, table 1A1–3 should be used. These distances depend on the ES providing protection against the expected thermal effects and controlled venting at the PES in a direction away from the ES. In all cases a minimum distance of 60 m must be used to ensure protection against radiant heat and firebrands, however, if the PES is an earth- covered building facing the ES and the ES cannot be regarded as being effectively protected against the effects of flame jetting and burning debris (see paragraph 122), a minimum of 240 m must be used.

b. For the less hazardous HD 1.3.4 EO, the distances are given in appendix 1, table 1A1–4.

PUBLIC TRAFFIC ROUTE DISTANCES

32. PTRD are the minimum permissible distances between PES and recognised PTR, which are routes used by the general public. They include roads, railways, waterways and footpaths. The distances depend on the NEQ stored in the PES and on the traffic density. The traffic density may be measured by the number of persons transiting in a unit of time (hour, day) averaged over a year. The traffic density may be considered at three levels; high, median and low traffic density.

33. The PTRD which apply at the different traffic levels follow:

a. High traffic density (eg constant, dense fast traffic): PTRD is equal to the full IBD known as the Major PTRD. For example major public traffic routes consisting of multi lane highways or freeways, Suburban train lines with frequent activity.

b. Median traffic density (eg the traffic may vary but its density is between high and low levels): PTRD is equal to 2/3 of the IBD (known as the Minor PTRD), except for the overriding minima. For example minor public traffic routes consisting of single lane roads.

c. Low traffic density: any distance between half the IBD and a minimum distance compatible with public safety is a candidate level. For example infrequently used country roads and railways.

34. Among the dominant factors which determine the number and severity of road casualties due to distraction by an explosive event are the traffic speed and density, the width of the traffic lanes and their number, the presence of crash barriers, the surface conditions and the radius of any bends. Factors of lesser importance are the presence or absence of roadside trees and ditches, and of separate carriageways for opposing traffic. For other types of routes, it is essentially the density and speed of the 'traffic' which are the critical factors. Where water borne traffic is concerned, consideration may need to be taken of special factors, eg passenger ferries, which, though they cross a hazarded area more quickly than other craft, merit special attention due to the numbers of people aboard.

35. It is important to appreciate that Public Traffic Routes, rights of way and common access areas should not be treated independently of each other or of any other constraints around a licensed site. They should be viewed within the overall picture and the guidelines used to indicate whether a particular situation is likely to require consideration. Ideally, a full risk analysis should be conducted to ascertain how these additional risks would fit into the overall risk picture. Only then can informed decisions be made regarding the soundness of a particular licence. The underlying principal of calculating the numbers of people exposed to the hazard and their relative times of exposure has been applied to allow the established recommendations for road users to be applied to other types of route.

Public traffic route distances for Hazard Division 1.1 and Hazard Division 1.2

36. Where debris or fragmentation hazards are considered to be dominant and the IBD is based on an appreciation of this hazard the PTRD is determined as 67 per cent (or 2/3) of the IBD. This rule is applied to both HD 1.1 and HD 1.2 situations. Attempts have been made within NATO Group of Experts to determine a relationship between debris hazards for IBD and PTRD without success, primarily because the variation of hazard with distance is too dependent on the specific hazard generator. PTRD are as follows:

a. The major PTRD are derived from the distances in column D13 in appendix 1, table 1A1–1. These distances are to be used for all roads if the nature of the traffic is such (eg constant, dense, fast traffic) that the reaction of drivers to sudden blast or fireball effects would result in unacceptable damage and injury.

b. The reduced minor PTRD, generally 2/3 of the IBD are derived from the distances in column D11 in appendix 1, table 1A1–1.

These distances are subject to overriding minimum distances.

Public traffic route distances for Hazard Division 1.3.3

37. PTRD for HD 1.3.3 are 2/3 of the IBD, except for the overriding minima. At these PTRD, the direct effects of blast, radiant heat and projections upon trains, ships and motor vehicles are minor.

Public traffic route distances for Hazard Division 1.3.4

38. PTRD for items HD 1.3.4, are constant distances based on an acceptable risk from fragments and lobbed EO to be expected in the first half-hour of an incident. It is assumed that traffic can be stopped before the final fragment saturation has been reached, otherwise the full IBD are used.

ANNEX A

INHABITED BUILDING DISTANCES

General

39. IBD are the minimum permissible distances between PES and inhabited buildings or assembly places. The distances are intended to prevent serious structural damage by blast, flame or projections to ordinary types of inhabited buildings (230 mm brick or equivalent) or caravans and consequently prevent death or serious injuries to their occupants. Persons in the open would not suffer direct injury from the blast or radiated heat, but may be struck by projections.

Inhabited building distances for Hazard Division 1.1

40. IBD for HD 1.1 are based on a tolerable level of damage expected from a peak side-on overpressure of 5 kPa. They are intended to ensure that the debris produced in an accidental explosion of HD 1.1 EO does not exceed one lethal fragment, having an energy of 80 joules or greater, per 56 m^2, at the IBD.

41. The distances given for EO of HD 1.1 in appendix 1, table 1A1–1, reflect the behaviour of typical packaged military EO. The IBD also envelope the effects of an explosion of bulk demolition explosives in wooden boxes or pallets in open stacks. In certain special circumstances, for NEQ less than 4500 kg, these distances are unduly conservative, since hazardous projections cannot arise. Such circumstances may occur at test sites and factories where bulk explosives, devoid of metal casing or components, are in fibreboard packaging, not on pallets, and are either in open stacks or in light frangible buildings. In these special circumstances column D13–distances may be used, as appropriate, without any overriding minimum distance for projections.

42. There is a significant hazard even at 270 m from EO of HD 1.1 due to fragments and a considerable amount of debris unless these projections are intercepted by structural protection. This hazard may be tolerable for sparsely populated areas, where there would be a small expectation of damage and injury from such projections, but in densely populated areas consideration should be given to the use of a minimum IBD of 400 m. This distance is required for earth-covered magazines and for heavy-walled buildings.

43. A 400 m minimum IBD is required to protect against structural debris from igloos, other earth-covered structures or untraversed buildings.

44. The Australia (AUS)/United Kingdom (UK) Stack Fragmentation Trials conducted since the late 1970s to study the distribution of fragments and debris when large stacks of HD 1.1 EO are detonated, demonstrated that for NEQ less than 5600 kg in an effectively traversed PES of light frangible construction, (typically 230 mm solid brick or less), then the hazard from projections may be tolerable at D12–distances subject to a minimum distance of 270 m. However, if the PES is of a heavier construction, typically 200 mm reinforced concrete or greater, then the hazard from projections requires a minimum distance of 400 m. For NEQ greater than 5600 kg, the prescribed IBD D13– distance will provide an acceptable degree of protection from both blast and projections. These trials also demonstrated that the hazard from projections is not constant and shows a marked directional effect. Basically, there is a very low ground density of projections in directions directly away from the corners of the structure. The density rises almost as an exponential function to a maximum in the direction normal to any face of the structure and is repeated on all sides of the structure, irrespective of whether the structure is traversed or not. It is extremely difficult to interpret the results to give general guidelines and it is advised that where it is considered that siting of the ES with respect to a PES might be beneficial, then the Stack Fragmentation Trial results must be considered in detail for each specific case.

45. Other aspects of the AUS/UK trials discussed in paragraph 44 are still under consideration for implementation by the NATO Group of Experts. In the interim, the Australian Explosives Storage and Transport Committee has authorised reductions in minimum QD requirements for PTRD and IBD for quantities less than 1800 kg based on definite trial data using these quantities. The minimum QD of 270 m and 400 m may be reduced to 180 m and 270 m respectively for the storage of NEQ of 1800 kg or less of HD 1.1 EO, provided the PES is effectively traversed and is of light frangible construction.

Buildings of vulnerable construction

46. The IBD for HD 1.1 are sufficient to prevent serious structural damage by blast to ordinary dwellings of 230 mm brick or equivalent but are not sufficient to prevent breakage of glass and other frangible panels or cladding used in the three types of buildings of vulnerable construction (see Glossary of Terms). This broken glass, cladding, etc, can cause injury to occupants and to those in the immediate vicinity of the buildings. Such buildings of vulnerable construction would be situated as follows:

a. Types 1 and 2 are considered to be of similar vulnerability, and such buildings should normally be situated at distances not less than two IBD (ie, >44.4 $Q^{1/3}$). However, such buildings, but probably not schools or hospitals, may be acceptable within the 44.4 $Q^{1/3}$distances, particularly if the population outside the building (on whom the displaced glass, etc, would fall) is small or virtually nil. When vulnerable buildings have been allowed within the 44.4 $Q^{1/3}$ distances on these grounds, it will be necessary to check at regular intervals that the original conditions (ie, the area around building free of people) have not changed.

Note

Although Shock Tube Trials have shown that virtually no hazard exist inside the building from window glass breakage, specific use buildings such as schools or hospitals of types 1 or 2 construction must be situated outside the 44.4 $Q^{1/3}$ distance.

b. Type 3 presents a difficult problem and is intended to cover the multiplicity of new construction types which have been introduced since the curtain wall concept was first developed. Each such building has to be treated on its merits, the hazard assessed and an appropriate QD selected. It is likely however, that this will fall in the 44.4 $Q^{1/3}$ region.

Inhabited building distances for Hazard Division 1.2

47. The IBD for HD 1.2 are based on a tolerable risk from fragments. Under normal conditions D1 and D2–distances given in appendix 1, table 1A1–2 must be used for inhabited buildings. A fixed distance of 180 m (for HD 1.2.2) or 270 m (for HD 1.2.1) independent of quantity, is permitted if arrangements are made to evacuate, or shelter, in an emergency persons who may be located within the D1 or D2–distances as appropriate. However, in any case, the D1 (for HD 1.2.2) or D2 (for HD 1.2.1) distance in appendix 1, table 1A1–2 must be used for hospitals, schools, churches, factories etc.

Inhabited building distances for Hazard Division 1.3

48. The IBD for HD 1.3 are based on a thermal flux criterion of 62.8 kJ per m2 (1.5 cal per cm^2) and also consider the effects of firebrands and augmentation of flame radius. It is anticipated that occupants of ordinary types of inhabited buildings would not suffer injury unless standing in front of windows; such persons and others in the open are likely to experience reddening of any exposed skin areas.

49. The IBD for HD 1.3 are as follows:

a. For the more hazardous EO of HD 1.3.3, the D4–distances prescribed in appendix 1, table 1A1–3 are used. These distances depend on the ES providing protection against the expected radiant heat from a PES. Therefore, in all cases a minimum distance of 60 m must be used. However, if the PES is likely to induce directional effects (see paragraph 1.15) and does not possess an adequate traverse (see paragraphs 122–123) then a minimum 240 m must be used to protect the ES against the effects of flame jetting and burning debris.

b. For the less hazardous HD 1.3.4 EO, the D4–distances given in appendix 1, table 1A1–4 are adequate to protect the ES against radiant heat however, a minimum of 60 m always applies.

DETERMINATION OF QUANTITY DISTANCES

Quantity distance tables

50. The QD required for each HD are given in tables in appendix 1.

51. For an intermediate quantity between those given in the tables, the next greater distance in the tables should be used when determining a QD. Conversely, the next lesser quantity in the tables should be used when determining an explosives quantity limit for a given intermediate distance. Alternatively, the distances corresponding to an intermediate quantity may be calculated from the distance function shown in the tables in appendix 1 and then rounded up in accordance with appendix 1, paragraph 3.

52. QD for a quantity of explosives greater than 250 000 kg are determined by extrapolation using the appropriate formula in appendix 1, as far as the explosives safety factors are concerned. However, adequate consideration must be given to the economic and logistic implications of such a large quantity in a single storage site.

53. The tables in appendix 1 provide QD for an igloo up to 250 000 kg NEQ. However, certain designs of igloo require a lower limit in the case of HD 1.1. The reason for this is that the blast load from an exploding igloo is a function of the NEQ, whereas the blast resistance of an exposed igloo depends upon its design. The limitation for a particular igloo must be obtained from the design authority.

54. Examples of the use of the QD tables are given in Procedure 1 to Regulation 5.4.

Measuring of quantity distances

55. QD are measured from the nearest point of the PES to the nearest point of the ES. Distances are measured along a straight line without regard to traverses or earth cover.

56. Where the total quantity of EO in a storage site or process building is so separated into stacks that the possibility of mass explosion is limited to the quantity in any one stack, distances are measured from the outside of the wall adjacent to the controlling stack of EO to the nearest outside wall of the other structure. If the separation to prevent mass explosion is provided by one or more substantial dividing walls, then the distances are measured from these walls, if appropriate, instead of from the outside wall of the building. Where not so separated, the total quantity subject to mass explosion is used for QD computations.

Net explosives quantity

57. The total NEQ of EO in a single PES is used for the computation of QD, unless it has been determined that the effective quantity is significantly different from the actual NEQ as calculated in accordance with Regulation 2.2 Procedure 1 —'Determination of the net explosives quantity'.

58. Where two or more PES are not separated by the appropriate IMD, they are considered as a single site and the aggregate NEQ is used for determining QD. If two or more HD are involved, the principles in paragraph 65 apply.

59. The total explosives content of fixed or semi-fixed ammunition classified as HD 1.2 is used in the computation of the NEQ for QD purposes.

60. The quantity of single base (Nitrocellulose (NC)) propellants, having a web size of 0.5 mm or more, in fixed or semi-fixed ammunition, and mortar ammunition in HD 1.1 may be excluded from the total NEQ used for computation of QD, except where this ammunition is stored underground or in an igloo. (Joint United States (US)/United Kingdom tests with small stacks of EO in the open have shown that such propellants do not contribute significantly to the blast from the high explosives in the projectiles. The effects of severe confinement, as in underground storage or in an igloo, are not known.)

61. The effects with double or triple-base propellants require specific evaluation.

Determination of quantity distances

62. The location of buildings or stacks containing EO with respect to each other and to other ES is based on the total NEQ in the individual buildings or stacks unless this total quantity is so subdivided that an incident involving any one of the smaller concentrations cannot produce a practically instantaneous explosion of the whole content of the building or stack.

63. The QD required from each of two or more nearby storage sites or process buildings to contain EO of one HD only are determined by considering each as a PES. The quantity of EO permitted in the storage sites or process buildings is limited to the least amount allowed by the appropriate table for distances separating the storage sites or process buildings concerned.

64. The QD required from each of two or more nearby storage sites to contain given quantities of EO of different HD at different times are determined as follows:

a. consider each building or stack, in turn, as a PES;

b. refer to the table for each HD which can be stored in the building or stack considered as a PES;

c. determine the QD for each HD as the minimum to be required from the building or stack; and

d. record the QD in terms of each HD in each instance as those to be required from the building or stack.

Alternatively, calculate the permitted quantity of each HD based upon the available distances.

Required quantity distances of explosive ordnance for more than one hazard division in a single site

65. When EO of different HD are kept in a single site at the same time, the required QD are determined, as follows, using the QD tables in appendix 1:

a. When EO of HD 1.4 is kept in the same site as EO of one or more other HD, the HD 1.4 is ignored subject to the overriding requirement of 25 m where appropriate, see appendix 1, paragraph 11.

b. When different types of EO of HD 1.2 are kept in the same site, the required QD is that given for the aggregate quantity taken as the more hazardous type, HD 1.2.1 (see subparagraph 9.a.).

c. When different types of EO of HD 1.3 are kept in the same site, the required QD is that given for the aggregate quantity requiring the largest QD in appendix 1, table 1A1–3 or 1A1–4 (see paragraphs 15–17).

d. When EO of HD 1.1 and 1.2 are kept in the same site, determine the QD for the aggregate quantity (ie the total quantity of HD 1.1 and 1.2) considered as HD 1.1. Next, determine the QD for the aggregate quantity considered as HD 1.2, taking account of subparagraph b., when appropriate. The required QD is the greater of these two distances.

e. When EO of HD 1.1 and 1.3 are kept in the same site, determine the QD for the aggregate quantity considered as HD 1.1. Next, determine the QD for the aggregate quantity considered as HD 1.3. The required QD is the greater of these two distances.

f. When EO of HD 1.2 and 1.3 are kept in the same site, determine the QD for the amount of HD 1.2. Next, determine the QD for the amount of HD 1.3. The required QD is the greater of these two distances (see also paragraph 66).

g. When EO of HD 1.1, 1.2 and 1.3 are kept in the same site, determine the QD for the aggregate quantity considered as HD 1.1, next as HD 1.2 and finally, as HD 1.3. The required QD is the greatest of these three distances.

Permissible quantities of explosive ordnance of more than one hazard division in a single site

66. When EO of different HD are kept in a single site at the same time, the permissible quantities are determined, as follows, using the QD tables in appendix 1:

a. When EO of HD 1.4 is kept in the same site as EO of one or more other HD, any quantity of HD 1.4 may be included subject to the availability of the 25 m distance where appropriate, see appendix 1, paragraph 11.

b. When different types of EO of HD 1.2 are kept in the same site, the permissible quantity is that given for the more hazardous type (see subparagraph 9.a.).

c. When different types of EO of HD 1.3 is kept in the same site, the permissible aggregate quantity is the lower quantity in appendix 1, table 1A1–3 or 1A1–4 (see paragraphs 15–17).

d. When EO of HD 1.1 and 1.2 are kept in the same site, the permissible aggregate quantity of HD 1.2 is determined as in subparagraph b. Next, determine the permissible quantity of HD 1.1. The permissible quantity of the combined HD is the smaller of these two quantities.

e. When EO of HD 1.1 and 1.3 are kept in the same site, determine the permissible quantity for each HD. The permissible quantity of the combined HD is the smaller of these two quantities.

f. When EO of HD 1.2 and 1.3 are kept in the same site, determine the permissible quantity for each HD separately. The two quantities may be stored independently.

g. When EO of HD 1.1, 1.2 and 1.3 are kept in the same site, determine the permissible quantity of HD 1.1 alone; next, determine the permissible quantity of HD 1.2 alone and, finally the permissible quantity of HD 1.3 alone. The permissible quantity of the combined HD is the smallest of these three quantities.

Exceptions to general rules for aggregation of hazard divisions

67. **HD 1.1 and 1.2.2.** In particular cases, where tests or other data warrant it, EO of HD 1.1 and 1.2.2 may be stored together without aggregation.

68. **HD 1.1 and 1.3.4.** In particular cases, where tests or other data warrant it, EO of HD 1.1 and 1.3.4 may be stored together without aggregation.

69. **HD 1.2 and 1.3.** There may be circumstances where it is prudent to consider the aggregate quantity of HD 1.2 and 1.3 as HD 1.1. This may occur where EO are the more hazardous types of HD 1.2 and form shaped charge jets close to the HD 1.3 in conditions of relatively heavy confinement. Further complications arise when the HD 1.3 EO are modern high energy type propellants. If these are stored with HD 1.2 EO capable of producing shaped charge jets then again the aggregate quantity should be treated as HD 1.1. All such cases should be assessed individually. It is not anticipated that an explosion of HD 1.2 would involve more than 5 kg NEQ at any point in time, and certainly never more than 50 kg. However, if individual HD 1.2 items have an NEQ greater than 5 kg, then the aggregated NEQ of such HD 1.2 munitions with HD 1.3 is to be treated as HD 1.1.

Relaxation of quantity distances

70. Relaxation of IQD:

a. **IMD.** Relaxation of IMD may result in the total loss of stocks in other buildings or stacks, or at least their being rendered unserviceable. Furthermore, a much larger explosion may result than that used as the basis for OQD. Significant damage to property and injury to the general public may be the consequence.

b. **PBD.** Relaxation of PBD may be permitted when a specially constructed building is available to protect against blast and debris or where the number of persons in the workshop is small (up to six persons).

71. Relaxation of OQD. Relaxation of OQD may increase the hazard to life and property. Relaxation is therefore permitted with the written consent of the appropriate authorities in accordance with Regulation 1.2 —'Deviations from Mandatory Explosives Safety Requirements'.

QUANTITY DISTANCES FOR CERTAIN TYPES OF EXPLOSIVE ORDNANCE

Traversed stacks of explosive ordnance

72. Stacks (modules) of bombs and similar explosive ordnance. D1–distances, for up to 30 000 kg NEQ and D2–distances, for from 30 001 to 120 000 kg NEQ, as shown in appendix 1, table 1A1–1 may be used between unboxed bombs of HD 1.1 under the following conditions:

a. the stacks are to be separated by effective earth traverses;

b. the bombs must be relatively strong so as to withstand intense airshock without being crushed;

c. there should be the minimum of flammable dunnage, etc, which could catch alight and lead to subsequent mass explosion of a stack; and

d. when the D1–distances are used, then the stacking height must not exceed 1 m.

In the event of an explosion in one stack, the distances will provide a high degree of protection against simultaneous detonation of bombs in adjacent stacks. Some of the bombs in the ES may be buried and not immediately accessible, some may be slightly damaged. There may be occasional fires and delayed low order explosions, particularly if the bombs are stacked on concrete storage pads.

73. Other unpackaged explosive ordnance of Hazard Division 1.1. In principle, the foregoing distances and conditions may be applicable to other kinds of unboxed EO of HD 1.1 and Compatibility Group D. An example is the 155 mm Shell M107, which has a robust steel casing and a relatively insensitive high explosive filling. Each case must be judged on its merits, using ad hoc tests or analogy with existing test data as requisite.

74. Cluster bomb units. Tests have shown that certain packaged cluster bomb units may be stored safely in accordance with paragraph 72. In this case, it is the robust containers rather than the heavy casings which prevent sympathetic detonation between stacks. Each type of bomblet and container must be carefully assessed to ensure a satisfactory combination for the application of this modular storage.

Buffered storage

75. Tests have shown that stacks of certain types of bombs can be stored in the same facility in such a manner separately by using buffer materials (EO as well as inert materials), that even though a high order detonation will propagate through one stack it will not propagate to the second stack. Storage under these conditions presents the risk of explosion of a single stack only, rather than mass risk involving all the stacks in one module, cell, or building. Hence, the NEQ of the larger stack plus the NEQ of the 'buffer' material, if any, may be used to determine the QD requirements for each entire module or building so used.

76. The storage of bombs using the buffered storage concept and basing the NEQ of storage on the NEQ of the larger stack plus the buffer material is authorised provided approved storage arrangements are used (see Annex B—'Above–ground storage—open stacks/buffered storage').

Untraversed stacks of TNT or Amatol filled shell

77. Certain types of TNT or Amatol filled projectiles of HD 1.1 may be stored in stacks which comply with the principle that, although a high order detonation would propagate throughout a stack, it would be unlikely to propagate from stack-to-stack. Storage under these conditions presents the risk of explosion of a single stack only, rather than a mass risk involving all the stacks in one module or building. Hence, the NEQ of the appropriate single stack may be used to determine the QD for each entire module or building so used. The types of projectiles suitable for storage in open stacks and the conditions applying to such storage are given in Annex B.

Untraversed storage of fixed ammunition with robust shell

78. Trials show that EO comprising robust shell, with an explosive content not exceeding about 20 per cent of the total weight (excluding propelling charges, cartridge cases and weight of packages) and with shell-walls sufficiently thick to prevent perforation by fragments produced by EO of HD 1.1, may be stored without traverses and without the risk of practically instantaneous explosion provided an increased QD (D9–distance) is used (see appendix 1, table 1A1–1).

Storage of complete rounds

79. Complete rounds of fixed or semi-fixed EO of HD 1.1 also involve the risk of HD 1.2. Therefore, the greater of the distances given in appendix 1, table 1A1–1 or 1A1–2 is to be observed for the storage of complete rounds of HD 1.1 EO.

Storage of propulsive rockets

80. Rockets stored in a propulsive state (ie unpackaged propulsive rockets and missiles in the assembled condition, waiting to be placed upon or into a tactical launcher or vehicle) present special problems in which the flight range of the rocket is the main safety criterion rather than the explosive content. Consequently, the rockets should be stored in special buildings or held by devices to prevent their flight (see Regulation 6.1 – 'Explosive Ordnance Buildings and their Construction'). The QD for the appropriate HD apply only when these conditions are met, except for the special case of missiles on launchers at a missile installation (see Annex D —'Quantity distance principles for missile installations'). Rockets or missiles in either an assembled or unassembled condition, when packaged as for storage and transport, do not in practice present the risk of significant flight.

Storage of very sensitive explosives

81. It is possible for the blast at an ES to cause practically instantaneous initiation of packaged primary explosive substances and certain other very sensitive explosive substances, such as blasting gelatine, even when traversed at the D4–distances in appendix 1, table 1A1–1. Storage conditions for such explosives are assessed individually, taking account of the protection afforded by packaging and the building at the ES.

Storage of depleted uranium explosive ordnance

82. For EO containing depleted uranium (DU) the QD will, in general, be those appropriate to the hazard division of the particular item in question. In some cases a special radiological safety distance may be required between a storehouse and the nearest point of public access if it is estimated that the adverse radiological/toxic effects of an atmospheric dispersion of DU could give rise to the possibility of injury to a member of the public comparable to that caused by the explosive components of the EO. In such a case the more restrictive of the two distances, the radiological/toxic safety distance or the explosives QD, is to be applied.

QUANTITY DISTANCES FOR CERTAIN EXPOSED SITES WITHIN AN EXPLOSIVE ORDNANCE STORAGE AREA

General

83. The QD criteria prescribed in paragraphs 84–99 are the minimum requirements to ensure a reasonable degree of safety from EO. Certain facilities, or their use, may however, menace the EO or, alternatively, may require additional protection from the EO. These aspects are dealt with herein.

Criteria for siting of holding, parking and staging areas

84. Vehicle holding, parking and staging areas whether enclosed in a building or in the open are collectively termed ‘Holding Facilities’, and are to be regarded as PES or ES, as appropriate. These facilities, which are normally to be within departmental property boundaries, involve the parking of vehicles, containers or loads. They are to be regarded as unoccupied facilities. However, short-term parking of an explosives laden vehicle eg the driver is required to complete a transaction at a control office on exit from a depot, does not attract a QD.

Criteria for siting of transhipment, marshalling, interchange, transit and transfer areas

85. EO transhipment, marshalling, interchange, transit or transfer areas whether enclosed in a building or in the open are collectively termed ‘Transfer Facilities’, and are to be regarded as PES or ES, as appropriate. These facilities, which are normally to be within departmental property boundaries, may involve one or more of the following operations:

a. the transfer of EO from one transport mode or vehicle to another mode or vehicle;

b. the receiving, dispatching and shunting of transport vehicles (road or rail) or EO containers;

c. the handling of consignments of packaged or palletised EO during conveyance or assembly for transhipment;

d. the receipt and dispatch of explosives consignments; or

e. EO container ‘stuffing’ or ‘destuffing’ operations conducted at a permanent site or where the total contents of multiple containers are not in direct connection with a single storehouse or activity.

Transfer facilities are normally to be regarded as occupied ES and therefore PBD are to apply. If however, operations are carried out for no more than one hour per eight hour shift, any reduced QD to D7 may be used (see subparagraphs 143.c. and 150.b.).

Facilities for the storage of empty packages and inert or non-explosive stores

86. Buildings containing empty packages or other inert materials should be separated from a PES by a distance based on the risk to the EO from a fire in the empty packages or other inert materials (minimum distance 25 m). Special consideration should be given to the separation of high- value packages from a PES.

Petrol, oil and lubricant storage sites and pipelines in an explosive ordnance area

87. QD criteria for the separation of Petrol, Oil and Lubricant (POL) storage sites and pipelines from PES are given in Annex C—‘Separation of petrol, oil and lubricant facilities within military installations’.

Separation of electric supply systems from an explosive ordnance area

88. There may be mutual hazards created by siting an EO area near to high voltage transmission lines, powerful transmitters, vital communications lines, etc. Each case must be assessed individually to take account of the voltage and power involved, the importance of the transmission lines, the time for the necessary repairs and the consequences of losing communications at a time when assistance may be required following an explosion. The assessment should be based on the following factors:

a. **Hazard from the EO.** The PTRD is a reasonable separation, subject to a minimum of 60 m, to protect public service or military emergency communication lines and overhead electrical power transmission lines exceeding 11 kV or associated substations from the effects of an explosion at a PES. Particularly important installations such as the lines of a supergrid network should be given greater protection from fragments and debris by affording them one or even one and a-half times IBD. This increased separation is also appropriate for microwave, ultra high frequency (UHF) reflectors which would be vulnerable to damage by air shock or debris and fragments. Minor transmission and communication lines such as those serving the buildings of the explosives area, may be sited in accordance with subparagraph b.

b. **Hazard to the EO.** The QD determined on the basis of subparagraph a. should be reviewed in the light of a possible hazard from electrical lines and transmitters to the EO. If any overhead transmission line approaches nearer to a building containing EO than one span between the poles or pylons, consideration should be given to the consequences of mechanical failure in the line. Arcing and large leakage currents may be set up before the supply could be isolated. Therefore, an overriding minimum separation of 15 m is prudent. Consideration should be given to siting unmanned generating stations and substations at least 45 m from any PES due to the small but real risk of fire, explosion or burning oil in such equipment. Powerful transmitters of electromagnetic energy may hazard electrically initiated EO. See Regulation 6.3 Procedure 1—'Safety Conditions for Electrical Installations and Equipment for Explosive Ordnance Areas'.

Grouped explosive ordnance buildings

89. Where the available IQD are inadequate to prevent instantaneous propagation from one building or area containing HD 1.1, to another containing HD 1.1, the total of the NEQ of all the buildings or areas involved is to be taken into account when assessing QD to other ES. However, where a mixture of HD either within individual buildings or within the group is involved, the licensing authority is to consider the effects on other ES.

Underground tanks and pipelines

90. Underground tanks and pipelines should be separated from buildings or stacks containing EO of HD 1.2, 1.3 and 1.4 by a minimum distance of 25 m. The distances from EO in HD 1.1 are to be at least $1.2Q^{1/3}$ with a minimum distance of 25 m.

Storage buildings for radioactive sources

91. It should not normally be required that radioactive sources be stored within an EO storage area, except for DU EO—see paragraph 82. Where such storage is necessary, the radioactive sources are to be kept in isolation (with no other types of dangerous goods) in a separate building of robust construction which would not be seriously damaged by an explosion within the EO area. Storage buildings for radioactive sources are to be separated from EO by a distance of not less than the PBD given in appendix 1 for the types of EO concerned. If stored underground, the separation distance must be as belonging to HD 1.1. If a building not of robust construction is used, the separation distance must be at least the IBD from the EO. Due consideration must be given to the type of construction of the buildings concerned.

Incinerators

92. Incinerators are not to be sited within an EO storage area.

Private vehicle parking areas adjacent to explosive ordnance facilities

93. The risk to personnel using private vehicle car parks within EO storage areas can be regarded as transient not requiring QD protection. However, whenever possible QD protection between PBD and PTRD should be provided.

94. Since permission granted to the parking of private vehicles implies no liability, suitable disclaimer notices appropriately positioned on the car park perimeter must be displayed.

95. Due account must be taken of security and fire risk to EO facilities adjacent to parking areas.

Fire assembly points

96. It is not considered feasible or practicable to specify specific QD for the protection of designated assembly points for mustering of staff in the event of a fire or similar incident. There are obvious advantages in instructing staff to remain at their normal place of work when the alarm is raised and to await further instructions, though it is recognised that such a policy does not lend itself to those establishments where small numbers of people may be scattered over a wide area, making supervision, mustering and communications extremely difficult.

97. The following factors are to be taken into account in determining the most effective means of mustering and protecting those staff who do not have specific firefighting or other related duties to perform:

a. the number of fire assembly points and their location should be provided in such a way as to avoid, as far as possible, a situation where, in order to reach the fire assembly point allocated to them, people could be heading towards or even past buildings or areas presenting the risk;

b. the number of fire assembly points should be such as to aid effective supervision, mustering and evacuation whilst at the same time minimising the co-location of large numbers of staff in EO areas;

c. fire assembly points should make the best possible use of local terrain, intervening structures, etc to provide protection from flying debris and thermal/fireball effects. Ideally such assembly points should be provided within the lee of a traversed building;

d. the siting of assembly points should take due cognisance of the particular risks to life and limb from an incident involving EO of HD 1.1 and bulk propellant where the build up to a mass explosion, and hence the time to evacuate, may be very short; and

e. fire orders should be reviewed to stress that due consideration must be given at an early stage to the proximity of fire assembly points to the building or area presenting the risk so that arrangements can be made to move non-essential staff to a safer area.

Shipping lanes and temporary berths in relation to barges containing explosive ordnance

98. The guidelines governing the siting of barges for EO in relation to shore establishments and other shipping, etc, are given in Annex G—'Safety principles for the transfer of explosive ordnance in naval ports'. These guidelines must be strictly observed to provide the required degree of safety. The separation distances prescribed will only ensure that damage is not caused to the hull or machinery of a ship by transmitted underwater shock. They will not prevent damage by fragments or projected debris. The position of the temporary berths and shipping lanes are to be agreed with the relevant local authority and suitably promulgated.

ANNEX A

Levels of protection

99. A more detailed examination of the levels of protection afforded by the QD is given in appendix 1 tables 1A1–1 to 1A1–4, and the structures and activities considered acceptable at each HD 1.1 protection level are given in paragraphs 134–60.

STORAGE BUILDINGS—GENERAL PRINCIPLES AND INFLUENCE ON QUANTITY DISTANCES

General

100. It is not considered practicable to construct surface buildings which will withstand direct attack by hostile activities. However, in order to reduce the hazards and the QD as much as possible, certain precautions in building construction should be observed.

101. The construction of buildings to store one HD only is uneconomic. Buildings may eventually be used for storage of different HD because storage requirements vary in the course of time.

102. The distances given in appendix 1, tables 1A1–1 to 1A1–4, are based on protection of people and the prevention of propagation of explosion. They do not take account of structural requirements, space for roads and access for firefighting. These practical considerations may require greater distances than given in the tables. Guidance on structural requirements is given in Regulation 6.1.

Igloos

103. A storage site comprising igloos (see Glossary of Terms) gives the simplest and safest set of IMD when it is set out as a rectangular array with the axes of the igloos parallel and the doors all facing one direction. A front-to-front configuration should be avoided since this requires a very large separation of the igloos. It may be expedient to arrange the igloos back-to-back in two rows, but this configuration may be less flexible for further development of the storage area.

104. Igloos which conform to the minimum design criteria in Regulation 6.1, paragraphs 1.4–14 qualify for reduced IMD compared with other types of above-ground magazines and open stacks. Igloos of a strength exceeding the minimum prescribed may warrant further reductions in IMD. Conversely, the earth-covered buildings described in appendix 1, subparagraph 8.c. require larger IMD. It is for the facilities authority to balance the cost of the various types of construction against the cost and availability of real estate and to determine the optimum solution for each particular situation.

Blast resistance of structures at exposed sites

105. It may be possible for a structure at an ES to fail under blast loading so that its contents are initiated practically instantaneously. This may be the result of major internal spalling from walls, implosion of the door(s) or catastrophic failure of the entire structure. The QD in appendix 1, table 1A1–1 presume that a structure at an ES is designed either to be strong enough to withstand the blast or to be so light that secondary projections from the structure do not initiate the contents. An ES containing EO vulnerable to attack by heavy spalling, eg missile warheads filled with relatively sensitive high explosives, requires special consideration—see Regulation 6.1.

Influence of protective construction upon quantity distances

106. A building with marked asymmetry of construction, such as an igloo or another building with protective roof and walls but with one relatively weak wall, induces very directional effects from flames and the projection of burning packages containing EO of HD 1.3. Otherwise, it is assumed for simplicity that the effects from HD 1.3 are symmetrical about a PES, although it is known that other structural characteristics and the wind can be significant.

107. Roofs may be designed to have special functions, such as:

a. containment of fragments and prevention of lobbing of EO (roof on an PES); and

b. shielding against blast, projections and lobbed EO (roof on an ES).

The QD for buildings which will contain fragments, etc, depend upon the particular design specifications. The reduced QD resulting from shielding roofs are incorporated in the QD tables in appendix 1.

108. Walls may be designed to exclude firebrands, projections and lobbed EO. The resultant reduced QD are incorporated in the QD tables in appendix 1. However, a reduction often depends also on the provision of shielding roofs.

Construction to contain fragments and to prevent lobbing

109. The design of structures to contain projections or lobbed EO of HD 1.1 is an extremely complicated procedure and, unless warranted because of other special circumstances, is prohibitive in terms of cost.

110. In practice, it is generally only feasible to design a structure to contain fragments or lobbed EO when the NEQ is small, or when the total content of the building is divided into smaller units by dividing walls which prevent the mass explosion of the entire contents of the building (in the event of explosion of one of the units). The design of a structure to contain projections and lobbed EO represents a more stringent requirement than that for dividing walls to prevent propagation.

Structures to protect from flame, projections and lobbed explosive ordnance

111. Protection from effects of explosive ordnance of Hazard Division 1.1.:

a. Protection against high velocity projections from the explosion of stacks of EO. Stacks in the open or in buildings can produce high velocity projections during an explosion. These projections may penetrate storage buildings and retain sufficient energy to initiate the contents practically instantaneously. Certain of the QD in appendix 1 QD tables (igloos, rows 7, 8 and 9) presume that the roof, headwall and door(s) of igloos at the ES will arrest these high velocity fragments. The presence of a traverse around the stack or building is always preferred because of the increased protection given against attack by high velocity projections.

b. Protection against the explosion on impact of lobbed EO. In the case of accident or fire, EO may be lobbed from any of the PES in appendix 1, table 1A1–1. EO is least likely to be lobbed from the PES described in columns a and b, and more likely to be lobbed as the PES description changes from c to f. These lobbed items may explode on impact (see paragraph 22). The fragments from these may penetrate stacks in the open or in a storage building, and retain sufficient energy to initiate the stacks practically instantaneously. Certain of the QD in the QD tables (igloos, rows 7, 8 and 9) presume that the roof, headwall and door(s) at the ES will arrest these high velocity fragments, but not necessarily lobbed items larger than 155 mm shell (see paragraph 22). The presence of a traverse around a building is always preferred and gives increased protection against the high velocity projections, with the exception of those arising from items lobbed over the traverse.

112. Protection from effects of explosive ordnance of Hazard Divisions 1.2 or 1.3. Certain types of construction provide a reasonable degree of protection against firebrands, comparatively low velocity projections, and lobbed EO (see Regulation 6.1). Examples are:

a. an earth-covered building with a headwall and door(s) of 150 mm reinforced concrete or equivalent;

b. a heavy-walled building (see Glossary of Terms); and

c. a traversed process building with a protective roof (see Glossary of Terms).

In such cases the smaller IQD in appendix 1, table 1A1–2 or 1A1–3 may be used. If the door or one wall etc, does not completely conform to the above requirements, such smaller distances should only be authorised after a special assessment of the relative orientation of the weak elements and the hazards involved.

TRAVERSES—GENERAL PRINCIPLES AND INFLUENCE ON QUANTITY DISTANCES

113. An effective traverse arrests high velocity projections at low elevation from an explosion which otherwise could cause direct propagation of the explosion.

114. A vertical faced traverse close to a PES also reduces the projection of burning packages, EO and debris.

115. A traverse may also provide limited protection against blast and flame arising either from an external or from an internal explosion when the quantity of EO is relatively small as it usually is in process buildings.

Influence of traverses upon quantity distances for Hazard Division 1.1

116. **IMD.** An effective traverse avoids the use of very large IMD around a site containing EO of HD 1.1. This is a significant factor in the cost of a storage depot. The reduced QD are given in appendix 1 table 1A1–1.

117. **PBD.** An effective traverse avoids the use of large PBD from PES containing EO of HD 1.1. A traverse or heavy wall around a process building considered as an ES may provide some protection for personnel in the lee of the traverse.

118. **OQD.** Investigation of damage caused by blast and projections in recorded accidents and trials shows that, in the case of HD 1.1, the difference between the OQD required for traversed and untraversed buildings or stacks respectively, is too small to be taken into account. However, AUS/UK stack fragmentation trials have demonstrated that there is a significant reduction in fragment/debris projection when a traverse is used around buildings with NEQ up to 5600 kg (see paragraph 44).

Influence of traverses upon quantity distances for Hazard Division 1.2 or 1.3

119. A traverse, other than a door traverse, does not itself generally provide sufficiently effective protection against flame, radiant heat, projections or lobbed EO to justify a reduction of the IMD around a PES containing HD 1.2 or 1.3. However, to achieve flexibility in the use of sites, each one should be effectively traversed.

Influence of door traverses upon quantity distances for Hazard Division 1.1

120. A door traverse is superfluous, as far as the use of IMD is concerned, when igloos or other earth-covered buildings are sited side-to-side or rear-to-rear. When the front of such a building at an ES faces the side or rear of an earth-covered building at a PES, a door traverse may intercept concrete debris but the major consideration is the blast resistance of the headwall and door(s) at the ES, and this is not much affected by the traverse. When such buildings are sited front-to-front, a door traverse may be ineffective. Regarding personnel hazards, a door traverse of reasonable height does not intercept debris which is lobbed or projected at a high elevation.

Influence of door traverses upon quantity distances for Hazard Division 1.2

121. A fire in an earth-covered building containing EO of HD 1.2 produces a serious hazard through the doorway from fragments and ejected EO. This hazard is reduced by providing a separate traverse, with a vertical wall facing the door. Such a traverse at an ES permits reduced distances as shown in appendix 1, table 1A1–2.

ANNEX A

Influence of door traverses upon quantity distances for Hazard Division 1.3

122. The deflagration of propellants in an igloo or similar earth-covered building produces marked directional effects in the hazardous sector which is taken to be the area bounded by lines drawn from the centre of the door and inclined 30° on either side of a perpendicular to the door. This hazard is reduced by a door traverse, at the PES, which has a vertical wall facing the door and is preferably backed with earth. Such a traverse permits the use of the reduced QD in appendix 1, table 1A1–3. This door traverse is not necessary when the door of the building at the PES faces an earth-covered rear or side wall of a building at an ES, or faces a process building which has both a traverse and a protective roof.

123. The burning of items other than propellants in an igloo or similar earth-covered building produces a hazard from fragments and projected items in the sector in front of the door. This hazard is reduced by providing a separate traverse, with a vertical wall facing the door of the PES, both at the PES and the ES. Such a traverse at both a PES and at an ES permits reduced distances as shown in appendix 1, table 1A1–4.

Quantity distances between earth-covered buildings with common earth cover

124. In the case of a detonation, the type of earth cover between earth-covered buildings affects the load on the acceptor igloo. The earth cover must be at least 600 mm. A minimum slope of two parts horizontal to one part vertical, starting directly above each edge of the roof, is recommended for the earth cover. The earth should comply with Regulation 6.1 Procedure 2 paragraphs 2.15–19. An earth-covered building often provides virtually complete protection to its contents from the effects of an incident at a PES containing EO of HD 1.2 or 1.3. When two or more buildings share a common earth cover, the amount of EO permitted in them is less than it would be if the buildings had separate earth cover. This is due to the earth couple between the two PES, meaning the earth will transmit the explosive shock loading with greater efficiency than air. In order to accommodate various types of earth, the following QD are applied:

a. If the two earth covers intersect at a point 3/4 the height of the structures or higher, column D5–distances apply.

b. If the two earth covers intersect at a point between 3/4 and 1/2 the height of the structures, column D4–distances apply.

c. If the two earth covers intersect at, or below, a point 1/2 the height of the structures, there is no QD reduction and column D3–distances apply.

These distances refer to earth-covered buildings as specified in Regulation 6.1 Procedure 1 Annex H—'Detailed information related to earth–covered magazines (igloos)'. In the case of unspecified earth-covered buildings in principle column D6–distances apply.

125. When earth-covered buildings, which meet the requirements of paragraph 122 and have an internal volume exceeding 500 m^3, are considered as PES, then for NEQ of HD 1.1 EO not exceeding 45 000 kg, the following QD may be applied to side and rear-configurations only:

a. **IBD.** D15–distances in appendix 1, table 1A1–1 may be used from the sides of the earth-covered building (PES) and D14–distances from the rear of the same building, but in no case must the QD be less than 400 m. Definitions of front/rear/side configurations are given in the note at appendix 1, paragraph 6.

b. **PTRD.** The PTRD may be reduced to 2/3 of the IBD (D14 and D15–distances respectively) as calculated in subparagraph a. with a minimum of 270 m. These distances (D16 and D17–distances) are shown in appendix 1, table 1A1–1. However, the full IBD (D14 and D15–distances) with a minimum distance of 400 m should be used, when necessary, in accordance with paragraphs 40–46.

Partly traversed buildings or stacks

126. Partly traversed buildings or stacks are considered effectively traversed only when both ends of the traverse extend 1 m beyond the ends of the protected sides of the buildings or stacks.

Natural traverses

127. It is acceptable to take advantage of natural terrain, eg hills and dense woods, when this provides protection equivalent to that of artificial traverses. However, it is found that natural hills are usually insufficiently steep or close to the EO and woods cannot usually be relied upon to provide adequate protection.

Traverse design criteria

128. The details of what constitutes an effective traverse are given in Regulation 6.1 Procedure 2.

INJURY AND DAMAGE TO BE EXPECTED AT DIFFERENT LEVELS OF PROTECTION FOR HAZARD DIVISION 1.1

Introduction

129. The purpose of applying HD 1.1 QD between PES and ES is to ensure that the minimum practical risk is caused to personnel, structures and facilities, and EO stocks. In principle, those functions and facilities not directly related to operating requirements or the security of EO should be sited at or beyond the IBD.

130. In practice, it may not always be possible to provide this level of protection and some activities and facilities will, of necessity, be sited at less than this distance. In other cases, the nature of the facility or structure requires that greater protection than that afforded by the IBD should be provided.

131. Damage to buildings and injury to personnel can result from either blast overpressure effects or from projections ie EO fragments and building debris from the PES. The severity of the effects will be dependent on the types of EO involved and the types of structures at the PES and at the ES. The levels of damage considered in the following section are when the PES is an:

a. open or lightly confined stack of EO; or

b. earth-covered building containing EO.

132. It should be noted that the expected effects quoted here are generally based on quantities in excess of 4500 kg. For smaller quantities, the damage levels given in this chapter may be too pessimistic. The QD criteria prescribed here are therefore the minimum requirements to ensure a reasonable degree of safety from EO. Certain facilities, or their use, may present a hazard to the EO or alternatively, may require additional protection from the EO. These aspects are also dealt with here.

Purpose

133. Guidance is provided at paragraphs 134–60 on the kinds of injuries and damage which can be expected at different QD for blast related effects, and to propose facilities and numbers of personnel for which these QD might be considered acceptable. The standard basis for predicting blast parameters is outlined in Regulation 6.1, modified as appropriate for charge configuration, suppression by earth- cover or other technical considerations. However, the hazards from projections are considerably less defined and are dealt with briefly in paragraph 137.

ANNEX A

Levels of protection

134. The blast overpressure effects at a given scaled distance can be predicted with a high degree of confidence. The technique is fairly well developed and the effects of blast may be treated deterministically while the hazards from projections would normally require a probabilistic approach.

135. Blast effects—open stacks and light structures. The blast overpressures from a light structure are essentially the same as that expected from a bare charge. This assumption is particularly valid as the scaled distance increases. The following levels of protection (scaled distances) are considered:

Scaled distance (Q (kg), distance (m))	Peak incident (side-on) Overpressure expected (bar)	Peak incident (side-on) Overpressure expected (KPa)
55.5 $Q^{1/3}$	0.015	1.5
44.4$Q^{1/3}$ to 33.3 $Q^{1/3}$	0.02 to 0.03	2 to 3
22.2 $Q^{1/3}$	0.05	5
14.8 $Q^{1/3}$	0.09	9
9.6 $Q^{1/3}$	0.16	16
8.0 $Q^{1/3}$	0.21	21
7.2 $Q^{1/3}$	0.24	24
3.6 $Q^{1/3}$	0.7	70
2.4 $Q^{1/3}$	1.80	180

Table 4A–1: Peak Incident Overpressure Expected at Scaled Distance for Open Stacks and Light Structures

136. Blast effects—earth-covered magazines. The earth-cover of earth-covered magazines will generally attenuate the blast overpressure, although in the near field enhanced overpressure can be expected from the front of an earth-covered magazine. The degree of reduction in blast overpressure from the sides and rear of a magazine decreases as the scaled distance and/or as the NEQ increases. In general the greatest reduction will be obtained from the rear of the earth-covered building. The following levels of protection (scaled distances) are considered:

Direction	Scaled distance (Q (kg), distance (m))	Peak incident (side-on) Overpressure expected (bar)	Peak incident (side-on) Overpressure expected (KPa)
Side	18.0 $Q^{1/3}$	0.05	5
Rear	14.0 $Q^{1/3}$	0.05	5
Side	12.0 $Q^{1/3}$	0.09	9
Rear	9.3 $Q^{1/3}$	0.09	9

Table 4A–2: Peak Incident Overpressure Expected at Scaled Distance for Earth Covered Magazines

Note

These scaled distances and associated overpressures do not apply when the NEQ is greater than 45 000 kg and when the volume of the igloo is less than 500 m^3.

For more detailed overpressures the US Department of Defence Explosives Safety Board's Blast Effects program can be accessed through the Directorate of Ordnance Safety.
Projection hazards—all types of PES. The projection hazard from a PES cannot be related to the scaled distance for blast effects. However, for all practical purposes, there is likely to be a hazard from projections at all scaled distances less than 14.8 $Q^{1/3}$, with the hazard being greater when the PES is not traversed. Unless the ES has been provided with protection against all projections, including high angle missiles, then minimum distances are to be applied as described in paragraphs 40–46.

Reduction of the hazard

137. Strengthening of buildings to prevent or reduce overpressure and projection hazards is feasible and may not be prohibitively expensive. The hazards may be reduced by:

a. suitably designed suppressive structures at the PES, although this may only be practical when the NEQ is relatively small eg reinforced concrete cubicles used in EO process building construction have a maximum practical limit of about 250 kg. Standard NATO igloos can suppress about 100 kg as a PES;

b. designing the structures at the ES to withstand the overpressures and the debris and fragment attack; or

c. the use of light structures for ES which, although they will be severely damaged by the overpressure, will be less likely to injure occupants as a result of building collapse. In this case, protection from high velocity fragments and debris by receptor traversing is essential.

GROUPING OF EXPOSED SITES

Grouping of exposed sites to determine quantity distances

138. In order to determine the QD requirements between PES and a variety of different ES, it is convenient to group ES according to the level of protection required from the hazards presented by the PES. ES are divided into five groups: I, II, III, IV and V. Although only the application of HD 1.1 QD criteria is addressed here, grouping of facilities also applies to HD 1.2 and 1.3 except that Group V facilities exist only relative to PES which contains HD 1.1 EO.

139. The following QD from appendix 1, table 1A1–1 apply to the different groups of ES:

a. IMD apply from a PES to facilities in Group I. The minimum applicable distance functions are:

(1) D1–0.35 $Q^{1/3}$;

(2) D2–0.44 $Q^{1/3}$;

(3) D3–0.5 $Q^{1/3}$;

(4) D4–0.8 $Q^{1/3}$;

(5) D5–1.1 $Q^{1/3}$;

(6) D6–1.8 $Q^{1/3}$;

(7) D7–2.4 $Q^{1/3}$;

(8) D8–3.6 $Q^{1/3}$;

(9) D9–4.8 $Q^{1/3}$; and

(10) D12–22.2 $Q^{1/3}$.

b. PBD apply from a PES to facilities in Group II. The minimum applicable distance functions are:

(1) D10–8.0 $Q^{1/3}$; and

(2) D13–22.2 $Q^{1/3}$.

c. PTRD apply from a PES to facilities in Group III. The minimum applicable distance functions are:

(1) 2 X D9–9.6 $Q^{1/3}$ (for military facilities only);

(2) D11–14.8 $Q^{1/3}$;

(3) D13–22.2 $Q^{1/3}$;

(4) D14–14.0 $Q^{1/3}$;

(5) D15–18.0 $Q^{1/3}$;

(6) D16–9.3 $Q^{1/3}$; and

(7) D17–12.0 $Q^{1/3}$.

d. IBD apply from a PES to facilities in Group IV. The minimum applicable distance functions are:

(1) D13–22.2 $Q^{1/3}$;

(2) D14–14.0 $Q^{1/3}$; and

(3) D15–18.0 $Q^{1/3}$.

e. Distances twice the IBD apply from a PES to facilities in Group V. The minimum applicable distance function is:

(1) 2 X D13–44.4$Q^{1/3}$.

FACILITIES OF GROUP I

General

140. The minimum separation distance from ES in Group I to a PES is to be equal to or greater than the IMD. The expected explosive effects and the personnel and facilities acceptable at the more common protection levels of D7 (2.4 $Q^{1/3}$) and D8 (3.6 $Q^{1/3}$) are detailed below. At distances of D1 to D6 the effects are too severe to propose any acceptable exposures.

Protection level D7 (2.4 $Q^{1/3}$)—open stacks and light structures

141. Expected blast effects. At D7–distances, blast effects are expected as follows:

a. Unstrengthened buildings will almost certainly suffer complete demolition.

142. Personnel and facilities acceptable. The level of protection provided by D7–distances is proposed as acceptable to the following personnel and facilities:

a. storage sites (such as building and stacks in the open) for storage of EO;

b. personnel performing package handling and shipping functions in magazines may operate for short periods of time at adjacent magazines providing operations do not exceed one hour per eight hour shift. In large magazine areas however, controls should be exercised by management to reduce the length of time that unrelated concurrent operations are being performed at distances less than 9.6 $Q^{1/3}$ (2 XD9);

c. receipt and dispatch buildings in an EO area where not more than six technical or supervisory persons are employed in duties directly involved in the receipt and dispatch of EO for not more than one hour per eight hour shift;

d. magazines in the vicinity of EO process buildings and auxiliary buildings for process building supply; and

e. vessels containing EO or on which EO is being handled, at an explosives jetty/wharf (and personnel onboard whether in the open or not).

Protection levels D8 (3.6 Q1/3)—open stacks and light structures

143. **Expected blast effects.** At D8–distances, blast effects are expected as follows:

a. unstrengthened buildings will suffer severe structural damage approaching total demolition;

b. severe injuries or death to occupants of the ES are to be expected from direct blast, building collapse or translation;

c. aircraft will be damaged by both blast and fragments to the extent that they will be beyond economical repair. If aircraft are loaded with EO, delayed explosions are likely to result from subsequent fires; and

d. a high degree of protection against direct propagation of an explosion is to be expected, provided direct attack by high velocity fragments is prevented, eg by a receptor traverse. Explosions may subsequently occur in an adjacent PES from fire spread by lobbed debris or blast damage to an ES.

144. **Personnel and facilities acceptable.** The level of protection provided by D8–distances is proposed as acceptable to the following personnel and facilities:

a. separation of buildings for security guard posts from EO locations, provided the risk of the personnel becoming militarily ineffective in the event of an explosive accident can be accepted;

b. separations among buildings and facilities of an operational missile site where greater distances cannot be provided due to tactical reasons;

c. truck and railcar waiting positions containing EO for supply to production and maintenance facilities, providing effective traversing is available between EO locations;

d. unmanned waste treatment and pollution abatement facilities and other utility installations (except electrical, see paragraph 89) which serve the EO storage area, and loss of which will not create an immediate secondary hazard or prejudice vital operations; and

e. buildings used to store strategic empty packages/containers.

FACILITIES OF GROUP II

Protection level quantity distance function 7.2 $Q^{1/3}$—open stacks and light structures

145. QD function 7.2 $Q^{1/3}$ is used by US Authorities to define EO workshop separation in the US and is comparable to protection level 8.0 $Q^{1/3}$. However, a great deal of information is available in the US for protection level 7.2 $Q^{1/3}$ and is included here for completeness.

146. **Expected blast effects.** At 7.2 $Q^{1/3}$–distances, blast effects are expected as follows:

a. buildings which are unstrengthened can be expected to suffer serious damage which is likely to cost above 50 per cent of the total replacement cost to repair;

b. personnel injuries of a serious nature or possible death are likely from debris of the building at the ES and from translation of loose objects;

c. there is 1 per cent chance of eardrum rupture to personnel;

d. some possibility of delayed communication of explosion as a result of fires or equipment failure at the ES. There is a high degree of protection against direct propagation of an explosion;

e. cargo ships would suffer some damage to decks and superstructure by having doors and bulkheads buckled by overpressure; and

f. aircraft can be expected to suffer considerable structural damage from the blast overpressure.

147. Personnel and facilities acceptable. The level of protection provided by 7.2 $Q^{1/3}$–distances is the minimum permissible between a PES and an EO process building. This level of protection is proposed as acceptable for the following personnel and facilities:

a. Workers engaged in major construction in the vicinity of EO production areas, waterfront areas where EO is being handled or areas used for the loading of aircraft with EO.

b. Labour intensive operations closely related to the PES, including inert supply functions serving two or more identical or similar PES.

c. Rest and buildings for light refreshment for use of workers in the immediate vicinity. Such facilities will normally only be used when work is stopped in the nearby EO buildings and should be limited to a maximum of six persons.

d. Area offices with a permanent occupancy of not more than six persons directly supporting the work of the EO storage area or process buildings.

e. Guard buildings in which those security personnel directly responsible for the security of the EO storage area are housed when not on patrol.

f. Unmanned buildings containing immediate reaction firefighting appliances.

g. Operation and training functions that are exclusively manned or attended by personnel of the unit operating the PES. This includes day rooms, squadron operations offices and similar functions for units such as individual missile firing batteries, aircraft squadrons, or EO supply companies. Manoeuvre area, proving grounds tracks and similar facilities for armoured vehicles together with the armoured vehicles themselves may provide adequate protection to the crew from fragmentation and debris.

h. Areas used for the maintenance of military vehicles and equipment (trucks, tanks) when the PES is basic load or ready storage limited to 4000 kg or less at each end when the maintenance work is performed exclusively by and for military personnel of the unit for which the basic load of EO is stored.

i. Auxiliary power and utilities functions, inert storage and issue sites and mechanical support at naval dock areas when not continuously manned, when serving only the waterfront area, and when the PES is a ship or an EO handling location at the waterfront. When loss of the facility would cause an immediate loss of a vital function, IBD must be used.

j. Minimum distance between separate groups of EO loaded combat-configured aircraft or between aircraft and a PES such as a preload site which serves to arm the aircraft. The use of intervening traverses is required to further reduce propagation and fragment damage and eliminate the necessity for totalling the NEQ. The loading of EO aboard aircraft can be accomplished within each group of aircraft without additional protection.

k. Parking lots for privately owned vehicles belonging to the personnel employed or stationed at the PES.

l. Separation of naval vessels from PES consisting of other naval vessels to which QD standards apply. When the PES is an ammunition ship or an EO activity, the separation will be determined by reference to special regulations established for piers and wharves of EO shiploading activities.

m. Container ‘stuffing’ and ‘destuffing’ operations which are routine support of the PES. When the PES is a magazine in a storage area, containerising operations may be considered as part of the magazine and separate QD rules will not be applied.

Protection level D10 (8.0 $Q^{1/3}$)—open stacks and light structures

148. Expected blast effects. At D10–distances, blast effects are expected as follows:

a. Buildings which are unstrengthened can be expected to suffer serious damage which is likely to cost above 30 per cent of the total replacement cost to repair.

b. Serious injuries to personnel, which may result in death, are likely to occur due to building collapse or loose translated objects.

c. There is some possibility of delayed communication of the explosion as a result of fires or equipment failure at the ES. Direct propagation of the explosion is not likely.

d. Cargo ships would suffer damage to decks and superstructure. In particular, doors and bulkheads on the weather-deck are likely to be buckled by the overpressure.

e. Aircraft are expected to sustain considerable structural damage.

149. Personnel and facilities acceptable. The level of protection provided by D10–distances is the minimum permissible between a PES and an EO process building. This level of protection is proposed as acceptable for the following personnel and facilities:

a. EO process buildings in which the personnel present are kept to the minimum essential for the task.

b. Receipt and dispatch buildings in an EO storage area where not more than six persons are employed in duties directly involved, and essential for, the receipt and dispatch of EO.

c. Area offices where not more than six persons are employed in duties directly involved in, and essential for supporting the work in the EO area or processing buildings.

d. Guards buildings.

e. Minor transmission and communication lines.

f. Depot equipment, small explosives jetty/wharf offices and non-explosives stores or work areas located in the EO area where a small number of personnel, up to six regular occupants, are normally exposed to risk for more than one hour per eight hour shift. Management should exercise control to reduce the length of time that unrelated personnel are exposed to risk.

g. Canteens/amenity buildings for up to 20 people and used mainly by people employed or associated with the EO facility, providing use is only during approved work breaks.

FACILITIES OF GROUP III

Protection level quantity distance function 9.6 $Q^{1/3}$ (2 X D9)—open stacks and light structures

150. Expected blast effects. At twice the D9–distance, the expected blast effects are as follows:

a. Buildings which are unstrengthened can be expected to suffer damage to main structural members which will require repair. Repairs may cost more than 20 per cent of the replacement cost of the building. Strengthening of buildings to prevent damage and secondary hazards is feasible and not prohibitively expensive.

b. Cars may suffer some damage to metal portions of the roof and body by blast. Windows facing the blast may be broken; however, the glass should not cause serious injuries to the occupants.

c. Aircraft will suffer some damage to appendages and sheet metal skin. They should be operational with only minor repairs.

d. Cargo type ships will suffer minor damage from blast to deck houses and exposed electronic gear.

e. Personnel may suffer temporary hearing loss; however, permanent ear damage is not to be expected. Other injuries from the direct effects of blast overpressure are unlikely, although there are likely to be injuries from secondary effects ie translation of objects.

151. Personnel and facilities acceptable. The level of protection provided should normally be the minimum distance at which unprotected defence and defence-related personnel ie troops, military and civilian maintenance and security personnel, and crews of ships are permitted when their duties are not closely and specifically related to the PES. Examples are:

a. open air recreation facilities where structures or the general public (which includes dependants of defence and defence-related personnel) are not involved;

b. training areas for unprotected military personnel; and

c. all military aircraft when the PES is not used for the immediate servicing of the aircraft.

Protection level D11 (14.8 $Q^{1/3}$)—open stacks and light structures

152. Expected blast effects. At D11–distances, the expected blast effects are as follows:

a. Unstrengthened buildings will suffer average damage costing in the range of 10 per cent of the total replacement cost to repair.

b. Personnel undercover are afforded a high degree of protection from death or serious injury. Such injuries as do occur will be mainly caused by glass breakage and building debris.

c. Personnel in the open are not likely to be seriously injured by blast but some injuries are likely to be caused by fragments and debris depending on the PES structure, amount of explosives in the PES and its fragmentation characteristics.

Note

ANNEX A

The equivalent protection levels to D11 in respect of earth-covered buildings greater in volume than 500 m3 and containing less than 45 000 kg NEQ of HD 1.1 are:

• From the side: 12.0 $Q^{1/3}$.

• From the rear: 9.3 $Q^{1/3}$.

153. Personnel and facilities acceptable. This distance is termed the ‘Public Traffic Route Distance’ and is the minimum distance, in conjunction with the overriding minimum distances given in paragraphs 40–46, at which routes used by significant numbers of the general public, for purposes unconnected with the EO facility, should be sited (except when the PES is a heavy-walled building and when the route is a main route or when the traffic is dense). This level of protection is proposed as acceptable for the following types of ES:

a. railroads, public roads and navigable waterways of minor to medium importance:

(1) railroads with a rail traffic density up to 48 trains within 24 hours,

(2) roads with a traffic density up to 1500 vehicles within 24 hours or up to 100 vehicles in any one hour, and

(3) waterways with a yearly traffic density of less than 1 000 000 metric loading tonnes or less than 5000 vessels.

b. facilities where people assemble only temporarily and which can be cleared quickly:

(1) public parks;

(2) cemeteries, with no significant structures;

(3) recreational areas, with no significant structures;

(4) golf courses, tennis courts and sports fields;

(5) public parking places;

(6) small arms ranges; and

c. airfield control towers; and

d. structures and facilities within an administrative area connected either directly or indirectly (eg licensing staff) within the EO installation with a limited number of occupants of up to approximately 20.

FACILITIES OF GROUP IV

Protection level D13 (22.2 $Q^{1/3}$)—open stacks and light structures

154. Expected blast effects. At D13–distances, the expected blast effects are as follows:

a. Unstrengthened buildings will suffer minor damage particularly to windows, doorframes and chimneys. In general, damage is unlikely to exceed approximately 5 per cent of the replacement cost but some buildings may suffer serious damage.

b. Injuries and fatalities are very unlikely as a direct result of the blast effects. Injuries that do occur will be caused principally by glass breakage and flying/falling debris.

Note

Earth-covered buildings—protection levels. The equivalent protection levels to D12/D13 in respect of earth-covered buildings greater in volume than 500 m3 and when containing less than 45 000 kg NEQ of HD 1.1 are:

• From the side: 18.0 $Q^{1/3}$.

• From the rear: 14.0 $Q^{1/3}$.

155. Personnel and facilities acceptable. This distance is termed the 'Inhabited Building Distance' and is the minimum distance, in conjunction with the overriding minimum distances given in paragraphs 40–46, at which inhabited buildings not directly connected with the functions of the EO area should be sited. This level of protection is proposed as acceptable for the following types of ES:

a. Structures and facilities in the administrative area of a depot but not within the EO area. Examples are:

(1) office buildings,

(2) workshops for general uses and utilities installations,

(3) mess halls and kitchen buildings,

(4) canteens,

(5) change and break rooms and shower facilities,

(6) accommodation blocks,

(7) fire stations,

(8) central heating plants,

(9) motor transport compounds,

(10) gasoline storage and dispensing facilities,

(11) unprotected central water supply and pumping station, and

(12) unprotected central power stations.

b. Inhabited buildings, whether single buildings, communities or areas of scattered habitations.

c. Structures and facilities in which people assemble, except as indicated in paragraph 158.

d. Community facilities in which persons permanently or temporarily assemble. Examples are:

(1) railway stations;

(2) ports/ship yards;

(3) churches;

(4) hospitals;

(5) schools and other educational facilities; and

(6) sports stadiums.

e. Facilities, which serve the safety and needs of the general public. Examples are:

(1) centrally-located installations for gas, water and electricity supply;

(2) radar and communication stations; and

(3) major electrical transmission lines.

f. Railroads, public roads and waterways of special importance subject to the following minimum traffic densities:

(1) railroads, with a daily capacity of more than 48 trains within 24 hours,

(2) roads with a traffic density of more than 1500 vehicles within 24 hours or over 100 vehicles in any one hour, and

(3) waterways with a yearly traffic density of more than 1 000 000 metric loading tonnes or more than 5000 vessels.

g. Untraversed stacks of EO.

FACILITIES OF GROUP V

Protection level 2 X D13 (44.4 $Q^{1/3}$)—open stacks and light structures

156. Expected blast effects. At twice the D13–distance the expected blast effects are as follows:

a. unstrengthened structures are likely to suffer only superficial damage;

b. when large panes of glass are exposed so as to face the PES, 50 per cent or more breakages may occur; and

c. injuries and fatalities are very unlikely as a direct result of blast effects. Injuries that do occur will be caused principally by glass breakage and/or falling panels.

157. Personnel and facilities acceptable. Because even superficial damage may in some instances be unacceptable, the siting of facilities of especially vulnerable construction or public importance may require siting at these distances. Examples are:

a. Large facilities of special/vulnerable construction or importance, eg:

(1) large factories;

(2) multistorey office or apartment buildings;

(3) public buildings and edifices of major value;

(4) large educational facilities;

(5) large hospitals;

(6) major traffic terminals (eg railway stations, airports, etc);

(7) major public utilities (eg gas, water, electricity works); and

(8) public works, eg bridges, dykes, locks, dams, etc damage to which will cause considerable inconvenience to the general public.

b. Facilities of vulnerable construction (see paragraph 46) used for mass gatherings:

(1) assembly halls;

(2) exhibition areas;

(3) amusement/theme parks; and

(4) sports Stadia.

c. Built-up areas which are both large and densely developed. Large buildings with many inhabited rooms or a number of buildings closely grouped are to be assessed on their merits.

Protection level 2 1/2 X D13 (55.5 $Q^{1/3}$)—open stacks and light structures

158. Expected blast effects. At two and one half times the D13–distance the expected blast effects will cause little or no damage to unstrengthened structures and injuries and fatalities are very unlikely. There may be a minor hazard from broken glass or cladding falling from a considerable height so as to strike people.

159. Personnel and facilities acceptable. At this distance and beyond there is no restriction on personnel, activities or facilities.

QUANTITY DISTANCE RULES FOR STORAGE OF EXPLOSIVE ORDNANCE OF HAZARD CLASSIFICATION CODE 1.6N

Preliminary remarks

160. Division 1.6 is defined as comprising extremely insensitive articles which do not have a mass explosion hazard. Such articles contain only extremely insensitive detonating substances and demonstrate a negligible probability of accidental initiation or propagation. The tests to which candidate Hazard Classification Code (HCC) 1.6N EO and its explosive filling is to be submitted are detailed in Test Series No 7 of the UN ‘Tests and Criteria Manual’ and are designed to ensure such a negligible probability.

Most credible accidental event

161. Accordingly, during storage of HCC 1.6N EO belonging to the same family the most credible accidental event resulting from an accidental stimulus is the detonation of a single article without propagation, either instantaneous or delayed, to other articles of the same family and/or moderate combustion of the whole quantity of EO.

Quantity distance rules

162. QD between an ES and a PES can be derived from consideration of the alternative ‘most credible accidental event’, by adopting the larger of the distances derived as follows:

a. the distance determined by considering the explosion effects generated by the detonation of a single article as the equivalent NEQ of HD 1.1 EO, stored in the PES; or

b. the distance determined by considering the explosion effects generated by the combustion of the total contents of the PES as the equivalent NEQ of HD 1.3 EO.

163. The actual distances to be employed in any given situation will depend principally, although not necessarily exclusively, on the following factors:

a. the NEQ and type of the individual EO,

b. the total NEQ of the PES,

c. the structure of the PES, and

d. the protection available at the ES.

164. One of the major difficulties in defining QD for the storage of EO classified HCC 1.6N is that there are no practical examples, other than special weapons. This in turn means that there is no practical experience of the hazards associated with the transport and storage of such EO.

165. Because of the lack of practical data and the interaction of the various factors listed above it is not feasible to produce generally applicable tables for HD 1.6. Each case must be judged on its own merits.

FRAGMENT VERSUS OVERPRESSURE EFFECTS

166. The NATO Safety Principles and associated QD criteria, prescribed in this instruction, are based on blast overpressure effects on facilities in the vicinity of an explosion. However, for quantities of HD 1.1 EO up to approximately 5 000 kg total NEQ, the distances prescribed by the QD Table, unless minimum distances are applied, eg 400 m minimum IBD for all quantities of HD 1.1 EO up to 5 000 kg, do not provide protection against fragment injury to exposed personnel and damage to facilities. For NEQ greater than 5 000 kg, the situation is reached where the NEQ is large enough for the blast distance specified to override the fragment distance required for the particular item of EO in question. Consequently, reduction of prescribed QD criteria not only increases the degree of damage and risk of injury from blast effects, but also will increase the probability of hit by fragments and debris at close-in distances, eg below 400 m from the source of the explosion.

Fragment Effects

167. Fragment distances provide adequate protection for personnel protected by structures from high speed, low angle fragments and from lower speed, high angle fragments. Personnel in the open are not adequately protected from these fragments. Some unprotected personnel will be struck by several ‘non-hazardous’ fragments. These multiple wounds can be fatal. At minimum fragment distances, up to 2% of the exposed personnel will be struck by hazardous fragments. These personnel will probably be killed. The quantity of an item involved in a simultaneous detonation does not ordinarily affect the fragment travel distance. Although the fragment pattern may vary slightly with quantity, the significant variation is in fragment density. See Table 4A-3 as an example of how fragment density decreases with distance from the point of detonation.

Distance from Explosion (metres)	Percentage Reduction in Number of Fragments
61	78.0
122	82.0
183	88.0
244	92.0
305	95.0
366	97.0
427	98.0
488	99.0
549	99.0
765	99.9

Table 4A–3: Computed Reduction in Number of Side Fragments - 750 lb M117 Bomb

NOTE

This table is based on sea level conditions, bomb axis horizontal and fragments less than 1 gram (maximum range 155 m) have been ignored.

ANNEX A

168. Table 4A-4 lists items of EO for which special detailed fragment studies have been made. The fragment distances specified are based upon risk to unprotected personnel. They apply to inhabited buildings, recreation areas, city streets, school yards, athletic stadia, churches, and similar locations where personnel are accustomed to congregate, ie Groups III, IV and V facilities - see paragraph 151 - 160. When the normal QD criteria for HD 1.1 prescribed in Appendix 1 (including minimum distance requirements) cannot be observed, and a relaxation to the criteria is being considered, the fragment (protection) distance criteria of Table 4A-4 may be employed in the following manner, for the items listed. The application of D13–distances less than 400 m in Table 1-A-1-1, Appendix 1 should only be permitted where this distance exceeds the fragment (protection) distance for the number of units under consideration. For ten or more units, the distance shown for ten units is the minimum permitted until the point is reached where this distance is exceeded by the D13– distance.

169. Deviations to the fragment distance be evaluated to ensure that personnel within the fragment range are adequately protected from the initial detonation and can be rapidly withdrawn from the area. The fragment producing items at the PES should be separated from each other as much as possible. This will slow down the rate at which the items detonate due to fire and will allow personnel to withdraw with the least possible exposure.

Fragments, Debris and Ejecta (Projection) Effects

170. Generally, provided personnel have protection from high speed, low angle and low speed, high angle projections, full PBD provide a tolerable degree of protection. Personnel in the open at these distances are not adequately protected, and some will be struck by several 'non-hazardous' projections. These multiple wounds can be fatal. At minimum PBD, exposed personnel will be struck by hazardous projections and be killed.

171. Ordinarily, the NEQ involved in a simultaneous detonation does not affect greatly the projection travel distance. Although the fragment pattern may vary slightly, the significant variation is in fragment density and, consequently, the probability of personnel in the open being hit by projections. Rock and soil ejecta ranges and probabilities of hit can be determined for varying NEQ from the Figure at Regulation 6.1 Procedure 1 Annex A.

Nomenclature				
	1 Unit	**2 Units**	**5 Units**	**10 Units** (2)
AGM-65A	120	155	155	155
AGM-88	120	-	-	-
AIM-7, Mk 38 Warhead	215	215	215	215
AIM-9	120	120	120	120
Bomb 750 lb M117A2	210	250	310	450
Bomb 500 lb Mk 82	205	265	330	380
Harpoon 155	155	-	-	-
Projectile 175 mm M437A2	140	180	255	630
Projectile 155 mm M107	120	155	220	455
Projectile 105 mm M1 (3)	85	110	155	305
Projectile 8 in Mk 25	160	230	295	380
Projectile 5 in Mk 49	85	130	200	305
Torpedoes (not over 680 kg total NEQ) (4)				

Notes:

1. Table 1-B-2 was developed for a limited number of items for which adequate fragmentation data is available. It may be extended by analogy to other items but care must be exercised in that they are truly analogous. For instance, a Navy 6 in/47 Composition A loaded projectile is analogous to the Navy 5 in/38 Composition A loaded projectile, but an Army 8 in projectile loaded with TNT or Composition B is not analogous to the Navy 8 in projectile loaded with Explosive D.
2. 10 units or more until the point is reached at which this distance is exceeded by the QD required by Table 1 of Annex A.
3. 105 mm projectiles and 105 mm complete rounds not in standard storage and shipping packages are HD 1.1 classification.
4. Torpedo fragment distances are applicable to torpedoes in warshot configuration, up to a gross NEQ of 680 kg.

Table 4A–4(1): Minimum Fragment (Protection) Distances for Selected HD 1.1 Items

172. Generally, full PTRD, and distances greater, provide adequate protection, for personnel in the open, from projections - however, criteria at Table 4A-4 and the Figure at Regulation 6.1 Procedure 1 Annex A, should be considered.

Overpressure Effects

173. The distance required to reduce overpressures from an explosion of mass detonating EO to an arbitrary level, depends on the scaling ‘K’ - factor and the NEQ of the EO (designated Q), in accordance with the distance function $D=KQ^{1/3}$ where:

a. D is the distance in metres;

b. K is the scaling factor1 derived by experiment and has the units metres/kilogram$^{1/3}$ (m/kg$^{1/3}$); and

c. Q is the NEQ (TNT equivalent value, where applicable) in kilograms.

Use Figure 4A3-1 of Appendix 3 to determine the K-factor for the level of overpressure under consideration. Multiply the cube root of the NEQ (TNT equivalent) by this K - factor to obtain the required distance.

174. **Overpressure Damage Assessment - Sample Calculations.** A method of solving (approximately) overpressure and distance problems for damage assessment purposes follows by example:

Assume a PES contains 12 000 kg (TNT equivalent) NEQ of HD 1.1 EO. If this quantity mass detonated:

Q1. *At what distance would 14 kPa (2psi) overpressure exist?*

A1. In solving Q1: *Locate 14 kPa on the left hand scale of Figure 1-B-1-1 in Appendix l; read horizontally to the curve, then read vertically down to the K-factor scale to 10.5; multiply K x $Q^{1/3}$ ie 10.5 x 22.9 in this case. The answer is 240.5 metres.*

Q2. *What overpressure would an ES at 180 metres experience?*

A2. In solving Q2: *Determine the K-factor by dividing the distance (180 m) by $Q^{1/3}$, ie 180/22.9 = 7.9m/kg$^{1/3}$ using K - 7.9 enter the bottom scale of Figure 1-B-1-1 and read vertically to the curve, then horizontally to the left hand overpressure scale. The answer is 21 kPa (3 psi).*

175. Appendix 4 provides some examples of the effects of overpressure (of short duration) on personnel and structural elements.

EFFECTS ON COMBAT AIRCRAFT

176. The degree of damage to an aircraft by a detonation not only depends on the distances, but on other factors such as the type of protection given, aircraft design and size, height of burst, and material ductility. Aircraft parked with the nose pointed toward the burst will suffer less damage than those with the tail or either side pointed toward it. Peak incident overpressures of 7 to 14 kPa (1 to 2 psi) are enough to dish in panels and buckle stiffeners and stringers. Peak incident overpressures of 28 to 40 kPa (4 to 6 psi) will cause damage beyond economical repair and/or total destruction. The following is generally accepted as damage classification guidance for aircraft:

a. **Minor Damage.** For overpressures up to 7 kPa (1 psi) flight of aircraft may not be prevented although performance may be restricted.

b. **Moderate Damage.** For overpressures of 7 to 14 kPa (1 to 2 psi) intermediate level maintenance may be required to restore aircraft to operational status.

c. **Major Damage.** For overpressures of 14 to 24 kPa (2 to 3.5 psi) depot level maintenance may be required to restore aircraft to operational status.

177. Traversed D7–distances (2.4$Q^{1/3}$) (approximately 180 kPa (26 psi)) or untraversed D9-distances (4.8$Q^{1/3}$) (approximately 50 kPa (7 psi) will prevent simultaneous propagation of EO on adjacent aircraft. It will not prevent delayed communication by fire or primary fragments from one aircraft to another.

178. A distance 7.0$Q^{1/3}$ (approximately 25 kPa (3.6 psi)) is the minimum distance offering a reasonable degree of protection against propagation between untraversed EO loaded aircraft.

179. The criteria in paragraphs 34 to 36 are provided as guidance for when risk is to be assessed. However, the criteria in Annex F are to be used for normal licensing of airfield EO operations.

Appendixes:
1. Quantity Distance Tables for Above-Ground Storage
2. Quantity Distance Criteria for Above-Ground Storage
3. Overpressure - K-Factor Conversion Chart
4. Equivalent Overpressure Values to Give Defined Blast Damage Descriptions

**APPENDIX 1 TO
ANNEX A**

QUANTITY DISTANCE TABLES FOR ABOVE-GROUND STORAGE

General

1. This annex provides criteria and the formulae used to generate values in the Quantity Distance (QD) tables presented at the end of this annex. The footnotes to the tables give helpful references to paragraphs in the parent chapter but they must not be used as a substitute for study of the full text.

Quantity distance criteria

2. QD criteria and the formulae used to generate values in the QD tables are given in Appendix 2 to this annex.

Rounding of quantity distances

3. The values of QD in the QD tables 4A1–1 to 4A1–5 have been calculated using the formula at the foot of the tables rounded up to the nearest metre.

Determination of quantity distances or permissible quantities

4. The method of determining QD or permissible quantities for various types of Potential Explosive Sites (PES) are given in Annex A paragraphs 61–68.

General notes on pictographs

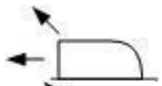
5. The pictographs in the following paragraphs are introduced to simplify the presentation of information in the QD tables. They are purely diagrammatic, and their shapes do not imply that actual structures should have similar shapes and proportions. The arrows indicate the direction of principal concern for blast, flame, radiant heat and projections. In an actual situation, every direction must be considered in turn. At a PES there are relatively few significant variations, but at an Exposed Site (ES) it is necessary to distinguish between the different types of construction and between the different functions of buildings. For these reasons, a given building may require one symbol when it is being considered as a PES and another symbol when it is considered as an ES.

Symbols for potential explosion sites

6. These descriptions are merely for ease of identification of the PES pictographs used in the QD tables. An ES is assumed to be to the left of each pictograph.

7. **Earth-covered building.** A building with earth on the roof and against three walls. Directional effects through the door and headwall are;

a. towards an ES

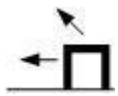


b. away from an ES.

c. perpendicular to the direction of an ES.

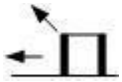
8. **Heavy-walled building.** A building of non-combustible construction used for explosive ordnance (EO) storage with walls of at least 680 mm brick, 450 mm reinforced concrete or equivalent penetration resistance of other materials;

a. with a protective roof of greater than 150 mm reinforced concrete.



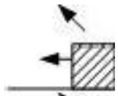
b. with a protective roof of greater than 150 mm reinforced concrete. Door faces an ES.

c. without a protective roof.

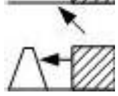


9. Medium-walled building. A building constructed with walls of at least 215 mm brick, or equivalent penetration resistance of other materials with suitable support.

a. Untraversed

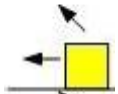


b. Traversed

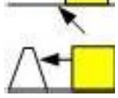


10. Open Stack, Lightweight Building, Truck or Trailer.

a. Untraversed



b. Traversed



Definitions of front/side/rear configurations for earth covered buildings

11. Directional effects from Igloos with Hazard Division (HD) 1.1 and 1.3. The directional effects for HD 1.1 or HD 1.3 from buildings which meet the design criteria for standard igloos (see figure 4A1-1) are considered to occur:

a. Through the door and headwall in the area bounded by lines drawn at 150° to the front face of the PES from its front corners.

b. Through the rear in the area bounded by lines drawn at a 135° to the rear-face of the PES from its rear corners.

c. All areas around a PES not included in the subparagraphs above of this note are considered to be to the side of the PES. In those cases where an ES lies on the line separating rear/side, etc of a PES, the appropriate larger QD should be observed.

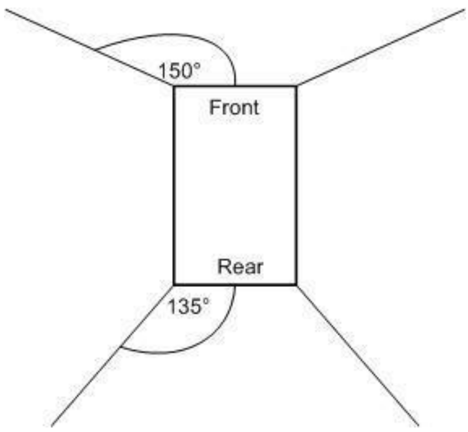


Figure 4A1-1: Igloo containing HD 1.1 or HD 1.3 as a potential explosion site

12. Directional effects from Igloos with HD 1.2. The directional effects for HD 1.2 from buildings which meet the design criteria for standard igloos or HD 1.2 containment buildings are considered to occur through the front in the area bounded by lines drawn at 100° to the front face of the PES from its front corners (see figure 4A1-2).

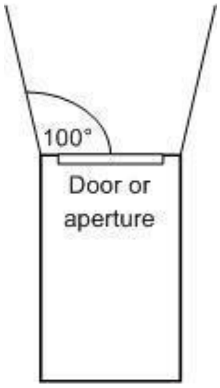
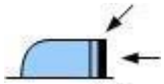


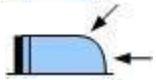
Figure 4A1-2: Igloo containing HD 1.2 as a potential explosion site

Symbols for Exposed Sites

13. These descriptions are merely for easy identification of the ES pictographs used in the QD tables. A PES is assumed to exist to the right of each pictograph.

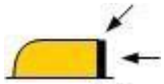
14. **Igloo designed for 7 bar.** Igloo designed in accordance with Regulation 6.1 Procedure 1 – Principles for Design and Construction, paragraph1.9;

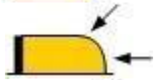
a. with the door towards a PES. 

b. with the door away from a PES. 

c. with the door perpendicular to the direction of a PES. 

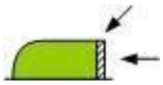
15. **Igloo designed for 3 bar.** Igloo designed in accordance with Regulation 6.1 Procedure 1 – Principles for Design and Construction, paragraph1.9;

a. with the door towards a PES. 

b. with the door away from a PES. 

c. with the door perpendicular to the direction of a PES. 

16. **Other earth-covered buildings.** Earth covered building used for EO storage, not complying with Type 4 – Igloo requirements of Regulation 6.1:

a. but with a headwall and door(s) resistant to high velocity projections and the door towards a PES. 

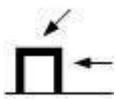
b. with the door and a door traverse towards a PES. 

c. with the door facing away from a PES. 

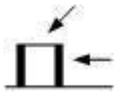
d. with the door facing perpendicular to the direction of a PES. 

e. with the door towards a PES. 

17. **Heavy Walled Building.** Building of non-combustible construction used for EO storage, with walls of at least 680 mm brick, 450 mm reinforced concrete or equivalent penetration resistance of other materials and:

a. a protective roof of over 150 mm concrete with suitable support. For this symbol to apply the door must be traversed if it faces a PES. 

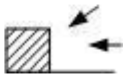
b. without a protective roof. For this symbol to apply, the door must be traversed if it faces a PES.



18. Medium Walled Building. Building constricted with walls of 215 mm brick (or equivalent) and:

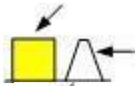
a. a protective roof of over 150 mm concrete with suitable support, with traverse.

b. a protective roof of over 150 mm concrete with suitable support, without traverse.

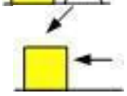


19. Open Stack, Lightweight Building, Truck or Trailer.

a. with a traverse.

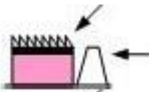


b. without a traverse.



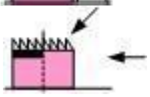
20. Process Building.

a. with a protective roof and with traverse.



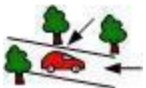
b. without a protective roof and with traverse.

c. with or without a protective roof and untraversed.



21. Public Traffic Route.

a. With low traffic density

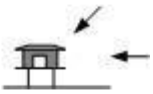


b. With medium traffic density

c. With high traffic density

22. Inhabited Buildings and Places of Assembly.

23. Vulnerable Constructions.



QUANTITY DISTANCE TABLES

24. The tables presented at the end of this annex contain information to determine suitable QD between sites, except for a PES containing EO of HD 1.4. Each QD table comprises two (or four for HD 1.1) pages. The left-hand page presents a matrix in which each cell represents a combination of a PES and an ES, and refers to one or more D–functions or constant values of distance. The right-hand page presents columns of tabulated values of QD generated from the distance function shown at the foot of each column, subject to any overriding minimum or maximum fixed distances. Where a cell in the matrix shows more than one option the selection is made on the basis of special conditions and the desired level of protection. References to specific paragraphs of this chapter appear at the foot of the matrix.

Hazard Divisions 1.1, 1.2 or 1.3

25. See the corresponding QD tables 1A1–1, 1A1–2, 1A1–3 or 1A1–4. Table 1A1–3 is used for the more hazardous items of HD 1.3 and table 1A1–4 mainly for the lesser hazardous items, see paragraphs 1.13–15.

Hazard Division 1.4

26. Separation distances from EO of HD 1.4 are not a function of the Net Explosives Quantity (NEQ). Stacks or vulnerable buildings should normally be separated by 25 m to prevent ignition by radiant heat, with a minimum of 10 m for fire resistant PES.

Potential Explosion Site		a	b	c	d	e	f
Exposed Site		a	b	c	d	e	f
	1	$D3_{ag}$	$D3_{ag}$	$D5_{a}$	$D5_{a}$	$D5_{a}$	$D4_{ag}$
	2	$D3_{ag}$	$D3_{ag}$	$D5_{b}$	$D5_{b}$	$D5_{b}$	$D4_{ag}$
	3	$D4_{agh}$ or $D5_{ag}$	$D4_{agh}$ or $D5_{ag}$	$D6_{be}$	$D6_{be}$	$D6_{be}$	$D4_{bghe}$ or $D6_{ae}$
	4	$D3_{ag}$	$D3_{ag}$	$D5_{b}$	$D5_{b}$	$D5_{b}$	$D5_{ag}$
	5	$D3_{ag}$	$D3_{ag}$	$D6_{b}$	$D6_{b}$	$D6_{b}$	$D5_{bg}$
	6	$D4_{bgh}$ or $D6_{a}$	$D4_{bgh}$ or $D6_{a}$	$D6_{ce}$	$D6_{ce}$	$D6_{ce}$	$D6_{ce}$
	7	$D4_{ag}$	$D4_{b}$ or $D5_{a}$	$D8_{bde}$ $D9_{bje}$ or $D12_{ae}$	$D8_{be}$	$D8_{bde}$	$D8_{bde}$
	8	$D6_{a}$	$D6_{a}$	$D9_{bde}$ $D9_{bje}$ or $D12_{ae}$	$D8_{be}$	$D8_{bde}$	$D8_{bde}$
	9	$D4_{bgh}$ or $D7_{b}$	$D4_{bgh}$ or $D7_{b}$	$D9_{ce}$	$D4_{cghe}$ or $D9_{ce}$	$D9_{ce}$	$D9_{ce}$
	10	$D4_{bgh}$ or $D7_{b}$	$D4_{bgh}$ or $D7_{b}$	$D9_{b}$	$D9_{b}$	$D9_{b}$	$D9_{b}$
	11	$D4_{bgh}$ or $D7_{b}$	$D4_{bgh}$ or $D7_{b}$	$D9_{cje}$	$D4_{cghe}$ or $D9_{ce}$	$D9_{cje}$	$D9_{cje}$
	12	$D4_{cgh}$ or $D7_{b}$	$D4_{cgh}$ or $D7_{b}$	$D4_{cghe}$ or $D7_{be}$	$D4_{cghe}$ or $D7_{be}$	$D4_{cghe}$ or $D7_{be}$	$D5_{cghe}$ or $D7_{be}$
	13	$D4_{cgh}$ or $D7_{b}$	$D4_{cgh}$ or $D7_{b}$	$D4_{cghe}$ or $D7_{be}$	$D4_{cghe}$ or $D7_{be}$	$D4_{cghe}$ or $D7_{be}$	$D5_{cghe}$ or $D7_{be}$
	14	$D4_{bgh}$ or $D7_{b}$	$D4_{bgh}$ or $D7_{b}$	$D4_{bghe}$ or $D7_{be}$	$D1_{bie}$ $D2_{bie}$ $D4_{bghe}$ or $D7_{be}$	$D1_{bie}$ $D2_{bie}$ $D4_{bghe}$ or $D7_{be}$	$D4_{bghe}$ or $D7_{be}$
	15	$D4_{bgh}$ or $D7_{b}$	$D4_{bgh}$ or $D7_{b}$	$D9_{cje}$ or $D12_{fe}$	$D1_{bie}$ $D2_{bie}$ $D4_{bghe}$ or $D7_{be}$	$D9_{cje}$ or $D12_{fe}$	$D9_{cje}$ or $D12_{fe}$
	16	D10	D10	D10	D10	D10	D10
	17	D10(>270m)	D10(>270m)	D10(>270m)	$D10_{o}$	$D10_{o}$	D10 (>270m)
	18	D10(>270m)	D10(>270m)	D13(>270m)	$D10_{o}$	D13(>270m)	D13 (>270m)
	19	$D11(>270m)_{k}$ $D16(>270m)_{kn}$ D13(>400m) $D14(>400m)_{n}$	$D11(>270m)_{k}$ $D17(>270m)_{kn}$ D13(>400m) $D15(>400m)_{n}$	$D11(>270m)_{km}$ $D13(>400m)_{m}$	$D11(>270m)_{km}$ $D11(>180m)_{kmp}$ $D13(>270m)_{m}$ $D13(>270m)_{mp}$	$D11(>270m)_{km}$ $D13(>400m)_{m}$	$D11(>270m)_{k}$ D13(>400m)
	20	$D13(>400m)_{l}$ $D14(>400m)_{ln}$	$D13(>400m)_{l}$ $D15(>400m)_{ln}$	$D13(>400m)_{l}$	$D13(>400m)_{l}$ $D13(>270m)_{lp}$	$D13(>400m)_{l}$	$D13(>400m)_{l}$

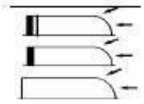
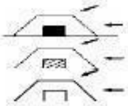
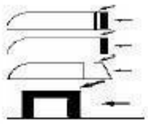
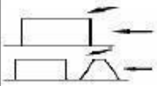
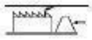
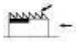
APPENDIX 1 TO ANNEX A

a. See Regulation 5.4 Annex A paragraphs 21–23a.—Virtually complete protection against instantaneous propagation.
b. See Regulation 5.4 Annex A paragraphs 21–23b.—High degree of protection against instantaneous propagation.
c. See Regulation 5.4 Annex A paragraphs 21–23c.—Moderate degree of protection against instantaneous propagation.
d. See Regulation 5.4 Annex A paragraph 111a.—Effect of high velocity projections.
e. See Regulation 5.4 Annex A paragraph 111b.—Effect of lobbed explosive ordnance.
f. See Regulation 5.4 Annex A paragraph 21—Degree of protection depends on structure at ES and sensitiveness of its
g. See Regulation 5.4 Annex A paragraph 81—Excluding very sensitive explosive substances.
h. See Regulation 5.4 Annex A paragraph 105—Excluding items at ES vulnerable to attack by heavy spalling.
i. See Regulation 5.4 Annex A paragraph 72–76—Modular storage of bombs etc in open stacks.
j. See Regulation 5.4 Annex A paragraph 78—Untraversed stacks of robust shell.
k. See Regulation 5.4 Annex A paragraphs 36—Reaction of drivers on busy roads.
l. See Regulation 5.4 Annex A paragraphs 40–46—Flying and falling glass etc.
m. See Regulation 5.4 Annex A paragraphs 40–46—Directional effects of debris.
n. See Regulation 5.4 Annex A paragraphs 125—Reduced QD for large earth-covered buildings < 45 000 kg.
o. See Regulation 5.4 Annex A paragraph 29—Serious fragment hazard.
p. See Regulation 5.4 Annex A paragraph 45—Reduced quantities in traversed lightweight building.

Table 1A1-1: Quantity Distance Matrix for Hazard Division 1.1

Table 1A1-1: Quantity Distances for Hazard Division 1.1

Net Explosives Quantity (NEQ) in kg	Quantity Distances (QD) in metres																
	D1	D2	D3	D4	D5	D6	D7	D8	D9	D10	D11	D12	D13	D14	D15	D16	D17
50	2		2	3	5	7	9	14	18	30	180	90	270	400	400	270	270
60	2		2	4	5	8	10	15	19	32	180	90	270	400	400	270	270
70	2		2	4	5	8	10	15	20	33	180	92	270	400	400	270	270
80	2		3	4	5	8	11	16	21	35	180	96	270	400	400	270	270
90	2		3	4	5	9	11	17	22	36	180	100	270	400	400	270	270
100	2		3	4	6	9	12	17	23	38	180	105	270	400	400	270	270
120	2		3	4	6	9	12	18	24	40	180	110	270	400	400	270	270
140	2		3	5	6	10	13	19	25	42	180	120	270	400	400	270	270
160	2		3	5	6	10	14	20	27	44	180	125	270	400	400	270	270
180	3		3	5	7	11	14	21	28	46	180	130	270	400	400	270	270
200	3		3	5	7	11	15	22	29	47	180	130	270	400	400	270	270
250	3		4	6	7	12	16	23	31	51	180	140	270	400	400	270	270
300	3		4	6	8	13	17	25	33	54	180	150	270	400	400	270	270
350	3		4	6	8	13	17	26	34	57	180	160	270	400	400	270	270
400	3		4	6	9	14	18	27	36	59	180	165	270	400	400	270	270
500	3		4	7	9	15	20	29	39	64	180	180	270	400	400	270	270
600	3		5	7	10	16	21	31	41	68	180	190	270	400	400	270	270
700	4		5	8	10	16	22	32	43	72	180	200	270	400	400	270	270
800	4		5	8	11	17	23	34	45	75	180	210	270	400	400	270	270
900	4		5	8	11	18	24	35	47	78	180	215	270	400	400	270	270
1000	4		5	8	11	18	24	36	48	80	180	225	270	400	400	270	270
1200	4		6	9	12	20	26	39	52	86	180	240	270	400	400	270	270
1400	4		6	9	13	21	27	41	54	90	180	250	270	400	400	270	270
1600	5		6	10	13	22	29	43	57	94	180	260	270	400	400	270	270
1800	5		7	10	14	22	30	44	59	98	180	270	270	400	400	270	270
2000	5		7	11	14	23	31	46	61	105	180	280	270	400	400	270	270
2500	5		7	11	15	25	33	49	66	110	185	305	280	400	400	270	270
3000	6		8	12	16	26	35	52	70	120	205	325	305	400	400	270	270
3500	6		8	13	17	28	37	55	73	125	220	340	330	400	400	270	270
4000	6		8	13	18	29	39	58	77	130	235	355	350	400	400	270	270
5000	6		9	14	19	31	42	62	83	140	255	380	380	400	400	270	270
6000	7		10	15	20	33	44	66	88	150	270	405	405	400	400	270	270
7000	7		10	16	22	35	46	69	92	155	285	425	425	400	400	270	270
8000	7		10	16	22	36	48	72	96	160	300	445	445	400	400	270	270
9000	8		11	17	23	38	50	75	100	170	310	465	465	400	400	270	270
10000	8		11	18	24	39	52	78	105	175	320	480	480	400	400	270	270
12000	9		12	19	26	42	55	83	110	185	340	510	510	400	415	270	275
14000	9		13	20	27	44	58	87	120	195	360	540	540	400	435	270	290
16000	9		13	21	28	46	61	91	125	205	375	560	560	400	455	270	305
18000	10		14	21	29	48	63	95	130	210	390	590	590	400	475	270	315
20000	10		14	22	30	49	66	98	135	220	405	610	610	400	490	270	330
25000	11		15	24	33	53	71	110	145	235	435	650	650	410	530	275	355
30000	11		16	25	35	56	75	115	150	250	460	690	690	435	560	290	375
35000		15	17	27	36	59	79	120	160	265	485	730	730	460	590	305	395
40000		16	18	28	38	62	83	125	165	275	510	760	760	480	620	320	415
45000		16	18	28	39	64	85	128	171	285	526	790	790	500	640	335	430
50000		17	19	30	41	67	89	135	180	295	550	820	820				
60000		18	20	32	44	71	94	145	190	315	580	870	870				
70000		19	21	33	46	75	99	150	200	330	610	920	920				
80000		19	22	35	48	78	105	160	210	345	640	960	960				
90000		20	23	36	50	81	110	165	220	360	670	1000	1000				
100000		21	24	38	52	84	115	170	225	375	690	1040	1040				
120000		22	25	40	55	89	120	180	240	395	730	1100	1100				
140000			26	42	58	94	125	190	250	420	770	1160	1160				
160000			28	44	60	98	135	200	265	435	810	1220	1220				
180000			29	46	63	105	140	205	275	455	840	1260	1260				
200000			30	47	65	110	145	215	285	470	870	1300	1300				
250000			32	51	70	115	155	230	305	510	940	1400	1400				
Distance Functions	$0.35\ NEQ^{1/3}$	$0.44\ NEQ^{1/3}$	$0.5\ NEQ^{1/3}$	$0.8\ NEQ^{1/3}$	$1.1\ NEQ^{1/3}$	$1.8\ NEQ^{1/3}$	$2.4\ NEQ^{1/3}$	$3.6\ NEQ^{1/3}$	$4.8\ NEQ^{1/3}$	$8.0\ NEQ^{1/3}$	$D11 = 3.6\ NEQ^{1/2}$ for NEQ<4500 kg $D11 = 14.8\ NEQ^{1/3}$ for NEQ>4500 kg	$22.2\ NEQ^{1/3}$	$D13 = 5.5\ NEQ^{1/2}$ for NEQ<4500 kg $D13 = 22.2\ NEQ^{1/3}$ for NEQ>4500 kg	$14.0\ NEQ^{1/3}$	$18.0\ NEQ^{1/3}$	$9.3\ NEQ^{1/3}$	$12.0\ NEQ^{1/3}$

Potential explosion site				
Exposed site		a	b	c
	1	No QD$_{ai}$	No QD$_{ai}$	No QD$_{ai}$
	2	No QD$_{ai}$	No QD$_{ai}$	No QD$_{ai}$
	3	No QD$_{ai}$	No QD$_{ai}$	No QD$_{ai}$
	4	No QD$_{ai}$	No QD$_{bi}$	No QD$_{bi}$
	5	No QD$_{ai}$	D7$_{cg}$ or D8$_{ch}$	D5$_{bg}$ or D6 $_{bh}$ D7$_{cg}$ or D8$_{ch}$
	6	No QD$_{ai}$	D5$_{bg}$ or D6$_{bh}$ D7$_{cg}$ or D8$_{ch}$	D5$_{bg}$ or D6$_{bh}$ D7$_{cg}$ or D8$_{ch}$
	7	No QD$_{ei}$	D3$_{eg}$ or D4$_{eh}$	D3$_{eg}$ or D4$_{eh}$
	8	No QD$_{ei}$	D3$_{fg}$ or D4$_{fh}$	D3$_{fg}$ or D4$_{fh}$
	9	No QD$_{ei}$	D5$_{fg}$ or D6$_{fh}$	D5$_{fg}$ or D6$_{fh}$
	10	No QD$_{k}$ 30 m$_{gl}$ or 60 m$_{hl}$	D5$_{gk}$ or D6$_{hk}$ D1$_{gl}$ or D2$_{hl}$	D5$_{gk}$ or D6$_{hk}$ D1$_{gl}$ or D2$_{hl}$
	11	No QD$_{m}$ 30 m$_{g}$ or 60 m$_{h}$	D1$_{g}$ or D2$_{h}$	D1$_{g}$ or D2$_{h}$

a. See Regulation 5.4 Annex A paragraph 23a.—Virtually complete protection against instantaneous propagation.
b. See Regulation 5.4 Annex A paragraph 23b.—High degree of protection against instantaneous propagation.
c. See Regulation 5.4 Annex A paragraph 23c.—Limited degree of protection against instantaneous propagation.
d. Reserved
e. See Regulation 5.4 Annex A paragraph 29.—High Degree of Protection for Personnel
f. See Regulation 5.4 Annex A paragraph 29— Limited Degree of Protection for Personnel contents.
g. See Regulation 5.4 Annex A paragraph 8-9— PES contains only less hazardous items classified HD 1.2.2.
h. See Regulation 5.4 Annex A paragraph 8-9— PES contains only more hazardous items classified HD 1.2.1.
i. See Regulation 5.4 Annex A paragraph 99—practical considerations will dictate specific separation distances.
j. See Regulation 5.4 Annex A paragraph 44—provision of shelter, evacuation.
k. See Regulation 5.4 Annex A paragraph 33—low Density Traffic.
l. See Regulation 5.4 Annex A paragraph 33—high Density Traffic.
m. If personnel can be evacuated promptly.

Table 1A1-2: Quantity Distance Matrix for Hazard Division 1.2

Table 1A1-2: Quantity Distances for Hazard Divisions 1.2.1 and 1.2.2

Net Explosives Quantity (NEQ) in kg	Quantity distances in metres							
	D1	D2	D3	D4	D5	D6	D7	D8
10	30	60	20	20	30	60	10	10
20	36	60	20	20	30	60	10	19
50	44	88	20	32	30	60	10	21
70	47	108	20	39	32	73	10	23
80	49	116	20	42	33	78	11	25
90	50	123	20	45	34	83	11	26
100	51	129	20	47	35	87	11	28
120	53	140	20	51	36	94	12	30
140	55	149	20	54	37	100	12	32
160	57	156	21	57	39	105	12	33
180	59	163	22	59	40	110	13	35
200	60	169	22	61	41	114	13	36
250	64	182	24	66	43	122	14	39
300	66	192	24	70	45	129	14	41
350	69	200	25	72	47	134	15	42
400	71	208	26	75	48	140	15	44
500	75	220	27	80	51	148	16	47
600	78	230	29	83	53	155	17	49
700	81	238	30	86	55	160	18	50
800	83	245	30	89	56	165	18	52
900	86	251	31	91	58	169	19	53
1000	88	257	32	93	59	173	19	54
1200	91	266	33	96	61	179	20	56
1400	94	274	34	99	63	184	20	58
1600	97	281	35	102	65	189	21	60
1800	100	287	36	104	67	193	21	61
2000	102	292	37	106	69	196	22	62
2500	107	303	39	110	72	204	23	64
3000	111	313	40	113	75	210	24	66
3500	114	320	42	116	77	215	24	68
4000	118	327	43	118	80	220	25	69
4500	120	332	44	120	81	223	26	70
5000	123	337	45	122	83	226	26	71
6000	127	346	46	125	86	232	27	73
7000	131	354	48	128	88	238	28	75
8000	135	360	49	130	91	242	29	76
9000	138	365	50	132	93	245	29	77
10000	141	370	51	134	95	248	30	78
12000	146	379	53	137	98	254	31	80
14000	150	386	54	139	101	259	32	82
16000	154	392	56	142	104	263	33	83
18000	157	397	57	143	106	266	33	84
20000	160	402	58	145	108	270	34	85
25000	166	412	60	149	112	277	35	87
30000	172	420	62	152	116	282	37	89
35000	177	426	64	154	119	286	38	90
40000	181	432	66	156	122	290	39	91
45000	184	437	67	158	124	293	39	92
50000	188	441	68	159	126	296	40	93
60000	194	449	70	162	130	301	41	95
70000	199	455	72	164	134	305	42	96
80000	203	461	74	166	137	309	43	97
90000	207	466	75	168	139	313	44	98
100000	210	470	76	170	141	315	45	99
120000	217	477	79	172	146	320	46	101
140000	222	483	80	174	149	324	47	102
160000	227	489	82	177	153	328	48	103
180000	231	493	84	178	155	331	49	104
200000	235	497	85	179	158	333	50	105
250000	245	510	88	185	165	340	52	110
500000	270	540	97	195	185	360	57	115
Distance Functions	D1 = 28.127-2.364*Ln(NEQ)+1.577*((Ln(NEQ))^2) D1 NEQ = exp[0.7495+ (-17.274 + 0.6341*IBD)1/2	D2 = -167.648+70.345*Ln(NEQ)-1.303*((Ln(NEQ))^2) D2 NEQ = exp[27.000- (600.287 - 0.768*IBD) 1/2	0.36*D1	0.36*D2	0.67*D1	0.67*D2	0.21*D1	0.21*D2

Potential explosion site / Exposed site	a	b	c	d	e	f
1	2 m_{ag}	2 m_{ag}	2 m_{ag}	10 m_{ad} or 25 m_a	10 m_{ad} or 25 m_a	10 m_{ad} or 25 m_a
2	2 m_{ag}	2 m_{ag}	2 m_{ag}	10 m_{ad} or 25 m_a	10 m_{ad} or 25 m_a	10 m_{ad} or 25 m_a
3	2 m_{ag}	2 m_{ag}	2 m_{ag}	10 m_{ad} or 25 $_{ma}$	10 m_{ad} or 25 m_a	$D1_a$
4	2 m_{ag}	2 m_{ag}	2 m_{ag}	10 m_{ad} or 25 m_a	10 m_{ad} or 25 m_a	10 m_{ad} or 25 m_a
5	2 m_{ag}	2 m_{ag}	2 m_{ag}	10 m_{ad} or 25 m_a	10 m_{ad} or 25 m_a	10 m_{ad} or 25 m_a
6	10 m_{ad} or 25 m_a	10 m_{ad} or 25 m_a	10 m_{ad} or 25 m_a	$D1_b$	$D1_b$	$D1_b$
7	2 m_{adg} or 25 m_a	2 m_{adg} or 25 m_a	2 m_{adg} or 25 m_a	25 m_{ad} or $D1_a$	25 m_{ad} or $D1_a$	$D1_{ad}$, $D1_{bf}$ or 240 m_b
8	2 m_{adg} or 25 m_a	2 m_{adg} or 25 m_a	2 m_{adg} or 25 m_a	25 m_{ad} or $D1_a$	25 m_{ad} or $D1_a$	$D1_{ad}$, $D1_{bf}$ or 240 m_b
9	2 m_{ag}	2 m_{ag}	2 m_{ag}	25m_a	25 m_a	$D1_a$
10	10 m_b or 25 m_a	10 m_b or 25 m_a	10 m_b or 25 m_a	$D1_a$	$D1_a$	$D1_{bf}$, or 240 m_a
11	25 m_a	$D1_a$	$D1_a$	$D1_b$	$D1_b$	240 m_b
12	2 m_{ag}	2 m_{ag}	2 m_{ag}	10 m_b or 25 m_a	10 m_b or 25 m_a	$D1_a$
13	25 m_a	$D1_a$	$D1_a$	$D1_b$	$D1_b$	240 m_a
14	25 m_a	$D1_a$	$D1_a$	$D1_b$	$D1_b$	240 m_a
15	25 m_a	$D1_a$	$D1_a$	$D1_b$	$D1_b$	240 m_a
16	D2	D2	D2	D2	D2	$D2_i$
17	D2	D2	D2	D2	D2	$D2_{fi}$ or 240 m_i
18	D2	D2	D2	D2	D2	240 m_{fi} or D4 (>240m)
19	$D3_h$ or D4	$D3_h$ or D4	$D3_h$ or D4	$D3_h$ or D4	$D3_h$ or D4	$D3_{fi}$ or 160 m_{hi} or $D4_f$, or $D4(>240\ m)_i$
20	D4	D4	D4	D4	D4	$D4_f$, or $D4(>240\ m)_i$

a. See Regulation 5.4 Annex A paragraph 25a.—Virtually complete protection.
b. See Regulation 5.4 Annex A paragraph 25b.—High/limited degree of protection.
c. Reserved
d. See Regulation 5.4 Annex A paragraph 112.— Resistance of headwalls and doors at ES.
e. Reserved
f. See Regulation 5.4 Annex A paragraph 122— Door Barricade at PES
g. See Regulation 5.4 Annex A paragraph 102— Practical considerations may require a greater distance.
h. See Regulation 5.4 Annex A paragraph 34— Low density traffic.
i. See Regulation 5.4 Annex A paragraph 16— Jetting and augumentation of flame radius.

Table 1A1-3: Quantity Distance Matrix for Hazard Division 1.3 (more hazardous items)

Table 1A1-3: Quantity Distances for Hazard Divisions 1.3.3 and 1.3.4

Net Explosives Quantity (NEQ) in kg	Quantity distances in metres			
	D1	D2	D3	D4
50	25	60	60	60
60	25	60	60	60
70	25	60	60	60
80	25	60	60	60
90	25	60	60	60
100	25	60	60	60
120	25	60	60	60
140	25	60	60	60
160	25	60	60	60
180	25	60	60	60
200	25	60	60	60
250	25	60	60	60
300	25	60	60	60
350	25	60	60	60
400	25	60	60	60
500	25	60	60	60
600	25	60	60	60
700	25	60	60	60
800	25	60	60	60
900	25	60	60	62
1 000	25	60	60	64
1 200	25	60	60	69
1 400	25	60	60	72
1 600	25	60	60	75
1 800	25	60	60	78
2 000	25	60	60	81
2 500	25	60	60	87
3 000	25	60	62	93
3 000	25	60	65	98
4 000	25	60	68	105
5 000	25	60	73	110
6 000	25	60	78	120
7 000	25	62	82	125
8 500	25	64	86	130
9 000	25	67	89	135
10 000	25	68	92	140
12 000	25	74	98	150
14 000	27	78	105	155
16 000	28	81	110	165
18 000	30	84	115	170
20 000	32	87	120	175
25 000	35	94	125	190
30 000	39	100	135	200
35 000	42	105	140	210
40 000	44	110	150	220
50 000	50	120	160	240
60 000	54	130	170	255
70 000	59	135	180	265
80 000	63	140	185	280
90 000	66	145	195	290
100 000	70	150	200	300
120 000	77	160	215	320
140 000	83	170	225	335
160 000	88	175	235	350
180 000	94	185	245	365
200 000	99	190	250	375
250 000	110	205	270	405
Distance Functions	**0.22 $NEQ^{½}$**	**3.2 $NEQ^{1/3}$**	**4.3 $NEQ^{1/3}$**	**6.4 $NEQ^{1/3}$**

Exposed site \ Potential explosion site	a	b	c	d	e	f
1	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}
2	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}
3	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}
4	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}
5	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}
6	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}	2 m_{ag}
7	2 m_{ag}	2 m_{ag}	10 m_{ad} or 25 m_a	10 m_{ad} or 25 m_a	25 m_{ad} or 60 m_a	25 m_{ad} or 60 m_a
8	2 m_{ag}	2 m_{ag}	10 m_{ad} or 25 m_a	10 m_{ad} or 25 m_b	25 m_{ad} or 60 m_a	25 m_{ad} or 60 m_a
9	2 m_{ag}	2 m_{ag}	10 m_a	10 m_a	25 m_a	25 m_a
10	2 m_{ag}	2m_{ag}	10 m_b or 25 m_a	25 m_b or 60 m_a	25 m_{be} or 60 m_{ae}	25 m_{be} or 60 m_{ae}
11	25 m_b or 60 m_a	25 m_b or 60 m_a	25 m_{bh}, 60 m_{ah} or 60 m_{bi}	60 m_b	60 m_b	60 m_b
12	2m_{ag}	2m_{ag}	10m_a	10m_a	10m_a	10m_a
13	25m_b or 60m_a	25m_b or 60m_a	25 m_{bh}, 60m_{ah} or 60m_{bi}	60m_b	60m_b	60m_b
14	25m_b or 60m_a	25m_b or 60m_a	25m_{bh}, 60m_{ah} or 60m_{bi}	60m_b	60m_b	60m_b
15	25m_b or 60m_a	25m_b or 60m_a	25m_{bh}, 60m_{ah} or 60m_{bi}	60m_b	60m_b	60m_b
16	25m	25m	25m	25m	25m	25m
17	60m	60m	60m	60m	60m	60m
18	60m	60m	60m	60m	60m	60m
19	60m_f or D4	60m_f or D4	60m_f or D4	60m_f or D4	60m_f or D4	60m_f or D4
20	D4	D4	D4	D4	D4	D4

a. See Regulation 5.4 Annex A paragraph 25a.—Virtually complete protection.
b. See Regulation 5.4 Annex A paragraph 25b.—High/limited degree of protection.
c. Reserved
d. See Regulation 5.4 Annex A paragraph 112.— Resistance of headwalls and doors at ES.
e. See Regulation 5.4 Annex A paragraph 123— Door Barricade at both ES and PES
f. See Regulation 5.4 Annex A paragraph 34— Traffic is stopped promptly to avoid worst attack.
g. See Regulation 5.4 Annex A paragraph 102— Practical considerations may require a greater distance.
h. See Regulation 5.4 Annex A paragraphs 106-48— Building (PES) with heavy walls with heavy roof.
i. See Regulation 5.4 Annex A paragraphs 106-48— Building (PES) with heavy walls without heavy roof.

Table 1A1-4: Quantity Distance Matrix for Hazard Division 1.3 (less hazardous items)

**APPENDIX 2 TO
ANNEX A**

QUANTITY DISTANCE CRITERIA FOR ABOVE-GROUND STORAGE

General—purpose and content

1. This appendix gives the criteria and the formulae used to generate values in the Quantity Distances (QD) tables given in appendix 1 of this annex. For each distance function, constant distance and minimum value in the tables there is a paragraph or subparagraph in the appropriate section of this appendix. Each one records the basis of the specific experimental observation or value judgment on which QD is based.

Basis of damage criteria

2. The United Kingdom (UK) Explosives Storage and Transportation Committee and North Atlantic Treaty Organisation use the concept of Radius 'B' (RB) damage as a basis for determining QD criteria for air shock, where 'B' damage is defined as such severe damage to traditional UK civilian dwellings to domestic construction of 230 mm brickwork to necessitate demolition. The damage radius is estimated from:

$$RB = \frac{5.6\ Q^{1/3}}{\sqrt[6]{\left(1 + \left(\frac{3175}{Q}\right)^2\right)}}$$

where:

Q = net explosives quantity (NEQ) in kilograms (kg)

RB = radius of 'B' damage in metres (m)

Acceptable damage criteria

3. The acceptable damage criteria for the Department of Defence is that damage, at Inhabited Building Distance (IBD), is unlikely to exceed approximately 5 per cent of replacement cost. However, because of varying building construction, it is accepted that some buildings may suffer more serious damage.

CRITERIA FOR QUANTITY DISTANCE TABLES FOR HAZARD DIVISION 1.1

Inter-magazine distances

4. **D1–distances and D2–distances.** Distance functions are:

a. $D1 = 0.35\ Q^{1/3}$ Valid for $Q \leq 30\ 000$ kg.

b. $D2 = 0.44\ Q^{1/3}$ Valid for $30\ 000 \leq Q \leq 120\ 000$ kg

5. **Explanation:**

a. The D1 and D2–distance functions are based on UK trials with traversed open stacks of aircraft bombs, and subsequently reviewed in the light of United States (US) trials on modular storage. The distances prevent simultaneous propagation of detonation to adjacent stacks beyond the earth traverses (see Regulation 5.4, Annex A—'Quantity distances for above-ground storage of explosive ordnance', paragraphs 72–74), though some damage to bombs and occasional fires or delayed explosions may occur.

b. The use of D2–distances is limited to situations not involving combustible materials and with only lightweight weather protection (i.e. metal shed roof or tarpaulin). Delayed propagation by fire should not occur.

6. D3–distances. The distance function is:

$$D3 = 0.5\ Q^{1/3}$$

This formula gives the normal minimum separation between the walls of adjacent igloos when the relevant roof and wall of the igloo at the Potential Explosion Site (PES) and that at the exposed site (ES) are both protected by the prescribed amount of earth.

7. Explanation. The D3–distances apply to any combination of rear-walls and side-walls. Thus, the headwall and door(s) of the acceptor igloo, at the ES, would not be exposed face-on to the blast from an explosion at the PES. This minimum separation should not be used in wet sand or wet clay which are associated with unusually large crater size and ground shock effects.

8. D4–distances. The distance function is:

$$D4 = 0.8\ Q^{1/3}$$

This formula is based upon French (Burlot) and United States (US) trials. D4–distances prevent propagation of an explosion by flame through the crater and by blast. Traverses give protection against propagation by projections.

9. Explanation. The D4–distances give normal minimum separation between the walls of adjacent igloos when either the relevant wall of the igloo at the PES or that at the ES is protected by the prescribed amount of earth, but not both. The D4–Distances apply when the front of the one igloo faces the rear-wall of another, provided the construction of the headwall and door(s) are of sufficient quality. Thus, the headwall and door(s) of the acceptor igloo would be exposed face-on to the blast from an explosion at the PES. This is why the peak overpressure specified in PFP(AC/326- SG/5)D(2010)0001 – Nationally Approved Structures for Explosives Areas, paragraph 2.3 c 2 b)[1] is greater than that given in paragraph 2.3 c 2 a) despite the greater distance. The use of igloos with their axes perpendicular presents special problems which require individual assessment. The D4- distances are not sufficient when the front of one igloo faces the side-wall of another (see paragraphs 13–17).

10. D5–Distances. The distance function is:

$$D5 = 1.1\ Q^{1/3}$$

This formula is used when the front of one igloo faces the side-wall of another.

11. Explanation. The D5–distances give the normal minimum separation between the side of a donor igloo (PES) and an acceptor headwall (ES) without significant risk of explosion communication (by impact of ejecta and structure debris).

12. D6–distances. The distance function is:

$$D6 = 1.8\ Q^{1/3}$$

This formula is based upon US trials. D6–distances prevent propagation of an explosion by flame and blast when the walls of the ES are of reinforced concrete at least 250 mm thick.

13. Explanation. The D6–distances give the normal minimum separation between the walls of adjacent igloos when the layout would qualify for the use of D4–distances but the design of headwall,

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[1] PFP(AC/326-SG/5)D(2010)0001 can be accessed through the Directorate of Ordnance Safety

doorframe or door(s) does not meet the stringent requirements specified in PFP(AC/326-SG/5)D(2010)0001 – Nationally Approved Structures for Explosives Areas, paragraph 2.3 c In some cases it may be economic to improve the design of these features in order to qualify for the smaller inter-magazine distances.

14. **D7–distances.** The distance function is:

$$D7 = 2.4\ Q^{1/3}$$

This formula is based upon French (Burlot) and UK trials. The D7–distances prevent propagation of an explosion by flame, heat and blast.

15. **Explanation.** To be issued.

16. **D8–distances.** The distance function is:

$$D8 = 3.6\ Q^{1/3}$$

This formula is based upon UK trials. The D8–Distances prevent propagation by fragments where the radius of fragments is greater than the flame radius.

17. **Explanation.** To be issued.

18. **D9–distances.** The distance function is:

$$D9 = 4.8\ Q^{1/3}$$

19. **Explanation.** To be issued.

Process building distances

20. The distance function is:

$$D10 = 8.0\ Q^{1/3}$$

This formula is based upon UK and US trials. The D10–distances protect personnel against severe injuries by blast.

21. **Explanation.** The D10–distance is the minimum distance from any aspect of an igloo to ensure that the blast effects are tolerable for a process building which is traversed and has a protective roof. The normal design load for a process building is free field overpressure of 0.2 bar, the positive duration (ms) is 4.0 $Q^{1/3}$ and the positive impulse per unit area is 0.4 $Q^{1/3}$ (bar ms).

22. **Minimum distance.** The minimum distance of D = 270 m is the minimum distance from an igloo at which the hazard from rocks and structural debris is tolerable for a process building which is untraversed or has no protective roof. This minimum distance is used in conjunction with the formula for blast protection given by D10–distances.

Public Traffic Route Distances

23. **D11–distances.** The distance functions are:

a. $D11 = 3.6\ Q^{1/2}$

   This formula is valid for Q < 4500 kg. The distances are two-thirds of the IBD given by D = 5.5 $Q^{1/2}$, suitably rounded.

b. $D11 = 14.8\ Q^{1/3}$

APPENDIX 2 TO ANNEX A

This formula is valid for Q > 4500 kg. The distances are exactly two-thirds of the IBD given by $D = 22.2\ Q^{1/3}$.

24. **Explanation.** To be issued.

25. **Minimum distance.** The minimum D11–distance is 180 m.

26. **D12–distances.** The distance function is:

$D12 = 22.2\ Q^{1/3}$

27. **Explanation.** To be issued.

Inhabited building distances

28. **D13–distances.** The distance functions are:

a. $D13 = 5.5\ Q^{1/2}$

This formula is valid for Q < 4500 kg. The distances were based originally on a UK analysis of bomb damage to traditional British brick dwellings including a survey of accidental explosions and trials. Subsequently, the US independently reappraised the expected damage from small explosions. The former reduction of distances by 20 per cent for Q < 3600 kg were abolished in the light of UK trials and US trials and statistical analysis of damage from accidental explosions. The distances do not correspond to a fixed value of peak overpressure. The expected degree of damage to dwellings is tolerable since the extent of buildings affected by an explosion not exceeding 4500 kg would not be great.

b. $D13 = 22.2\ Q^{1/3}$

This formula is valid for Q > 4500 kg. The distances were based originally on the same analysis as in subparagraph a. The US had at the same time adopted values tending to $20\ Q^{1/3}$, based on a review of a comprehensive study of damage to dwellings of North American construction from a very large accidental explosion. Subsequently, the criterion 50 mb peak overpressure for all normal types of construction (excluding curtain wall) and for caravans, in the context of the tolerable degree of damage to a limited number of dwellings (individual risk), was adopted. Discussion continues on the tolerable extent of such damage (group risk).

29. **Explanation.** To be issued.

30. **Minimum distances.** The minimum D13–distances are:

a. **D13 = 270 m.** This distance is the minimum distance at which the risk of injury from projections for an individual in a dwelling is considered to be tolerable in sparsely populated areas (i.e. individual risk). It is not tolerable in a built-up area (group risk), nor in the vicinity of an igloo which produces many pieces of structural debris.

b. **D13 = 400 m.** This distance is the minimum distance for tolerable group risk in a built-up area. It is also the minimum distance for tolerable individual risk in a sparsely populated area near an igloo which produces many pieces of structural debris.

Special distances

31. **D14 and D15–distances.** The distance functions are:

a. $D14 = 14.0\ Q^{1/3}$; and

b. D15 = 18.0 $Q^{1/3}$.

32. Explanations:

a. The D14 and D15–distances are based on US full scale and model trials.

b. D14–distances are used for IBD from the rear of, and D15-distances from the side of, earth-covered buildings acting as a PES. The buildings must meet the requirements of Regulation 5.4 Annex A, paragraphs 124–25, have an internal volume exceeding 500 m^3 and have a net explosives quantity (NEQ) of HD 1.1 Explosive Ordnance (EO) not exceeding 45 000 kg. In no case may the QD be less than 400 m.

33. D16 and D17–distances. The distance functions are:

a. D16 = 9.3 $Q^{1/3}$; and

b. D17 = 12.0 $Q^{1/3}$.

34. Explanations:

a. The D16 and D17–distances are based on US full scale and model trials.

b. The D16 and D17–distances are the Public Traffic Route Distances (PTRD) corresponding to D14 and D15 IBD. The D16–distances therefore apply to the rear of, and the D17–distances to the side of, an earth-covered building acting as a PES. The buildings must meet the requirements of Regulation 5.4 Annex A, paragraphs 124–25, have an internal volume exceeding 500 m^3 and have a NEQ of HD 1.1 EO not exceeding 45 000 kg. In no case may the QD be less than 270 m. However, the full IBD (D14 and Dl5–distances) with a minimum of 400 m should be used, when necessary, in accordance with Regulation 5.4 Annex A, paragraphs 40–46.

CRITERIA FOR QUANTITY DISTANCE TABLE 1A1–2 IN APPENDIX 1

Inter-magazine distances

35. No QD. No quantity distance when the PES contains the fragments and/ or debris or the ES offers protection against fragments and/or debris from the PES.

36. Explanation. The removal of QD for certain PES/ES combinations is based on large scale HD1.2 trials conducted at Woomera in September 1996.

37. D5 and D6-distances. The distance functions are:

a. D5 = 0.67 D1; and

b. D6 = 0.67 D2.

38. D7 and D8-distances. The distance functions are;

a. D7 = 0.21 D1; and

b. D8 = 0.21 D2

39. Explanation. To be issued.

Process building distances

40. No QD. No quantity distance when the PES contains the fragments and/ or debris or the ES offers protection against fragments and/or debris from the PES.

41. **Explanation.** The removal of QD for certain PES/ES combinations is based on large scale HD1.2 trials conducted at Woomera in September 1996.

42. **D3 and D4-distances.** The distance functions are:

a. D3 = 0.36 D1;

b. D4 = 0.36 D2;

c. D5 = 0.67 D1; and

d. D6 = 0.67 D2.

43. **Explanation.** The PBD is generally determined as 36% of the IBD. Where the process building is protected by a traverse and has a protective roof, it is considered that the occupants are afforded a higher degree of protection. If the ES is either not traversed or does not have a protective roof the level of protection to occupants decreases. In the absence of any protective features to the ES, such as a traverse or a protective roof, the level of protection limited and such process buildings are to be sited at PTRD unless prompt and safe evacuation of personnel can be assured.

Public traffic route distances

44. Distance functions. The distance functions are:

a. $D1 = 28.127 – 2.364\ Ln(NEQ) + 1.577((Ln(NEQ)^2)$;

b. $D2 = -167.648 + 70.345\ Ln(NEQ) – 1.303\ ((Ln(NEQ))^2)$.;

c. D5 = 0.67 D1; and

d. D6 = 0.67 D2

45. **Explanation.** The D1 or D2–distances, depending on the calibre of the EO in the PES and the density of the traffic.

CRITERIA FOR QUANTITY DISTANCE TABLE 1A1–3 IN APPENDIX 1

Fixed distances

46. **D = 2 m.** The D = 2 m distance is used, providing virtually complete protection, whenever the PES is an earth-covered building or heavy walled building with or without protective roof, which is side or rear-on to the side, rear or face (when doors and headwall are resistant to fire) of an ES which is an earth-covered building or building of non-combustible construction with walls of 70 cm concrete, brick or equivalent with protective roof.

47. **Explanation.** To be issued.

48. **D = 10 m.** The D = 10 m distance is used, providing high/limited degree of protection, whenever the PES is an open stack or light structure, traversed or untraversed, or earth-covered building with door facing the ES and where the ES is a side-on earth-covered building (not complying with PFP(AC/326-SG/5)D(2010)0001 – Nationally Approved Structures for Explosives Areas, paragraph 2.3 c) or a traversed open stack or light structure.

49. **Explanation.** To be issued.

50. **D = 25 m.** The D = 25 m distance is used as alternative to 2 m or 10 m to provide a better degree of protection or in cases where resistance of headwall and doors is inadequate.

51. **Explanation.** Known as fire fighting distance, the D = 25 m distance prevents ignition of buildings and stacks by radiant heat, whilst UK and US trials with propellants in buildings designed to vent through the door end show that the contents of the buildings are thrown through the front only.

52. **D = 160 m.** The D = 160 m distance is used as the minimum distance for public traffic routes when the PES is an unspecified earth-covered building with door facing the route and the likely reaction of drivers on busy roads is considered to be acceptable.

53. **Explanation.** The D = 160 m is 2/3 minimum IBD used for PES detailed in paragraph 52.

54. **D = 240 m.** The D = 240 m distance is the minimum IBD when the PES is an unspecified earth-covered building with door facing the inhabited building.

55. **Explanation.** The D = 240 m distance is based upon US trials with propellants. It is the minimum distance for protection against burning items projected by mortar effect (eg directional projection).

Distance functions

56. **D1–distance:**

$$D1 = 0.22\ Q^{1/2}$$

D1–distances are used, with a minimum of 25 m, in those cases when because of orientation or construction of either PES or ES, the 25 m fixed distance is inadequate.

57. **Explanation.** The D1–distance function is based upon UK trials with propellants and derived from UK formula $D = 1.05\ W^{0.44}$. Distances protect against communication by flame and heat.

58. **D2–distance:**

$$D2 = 3.2\ Q^{1/3}$$

D2–distances are used, with a minimum of 60 m, as the distance to workshops from all types of PES except when the PES is an unspecified earth-covered building with untraversed door facing the workshop.

59. **Explanation.** The D2–distance function is based upon UK and US trials with propellants and is derived from UK formula $D = 8\ W^{1/3}$, which corresponds to the US formula $D = 7\ W^{1/3}$ (approximately). Distances protect against effect of radiant heat. Heavy walled buildings are considered to give no appreciable protection against this hazard.

60. **D3–distance:**

$$D3 = 4.3\ Q^{1/3}$$

D3–distances are used as PTRD, with a minimum distance of 60 m (but see paragraphs 52–53.), when the reaction of drivers on busy roads is considered to be acceptable.

61. **Explanation.** The D3–distances are 2/3 the IBD. The distances are reduced in conformity with UK wartime and US current practices. Distances give a reasonable degree of protection against flame, heat and lobbed EO.

62. **D4–distance:**

$$D4 = 6.4\ Q^{1/3}$$

D4–distances are used as IBD with a minimum of 60 m (but see paragraphs 54–55).

63. **Explanation.** The D4–distance function is based upon UK trials with propellants. It is derived from UK formula $D = 16\ W^{1/3}$. The distances protect against flame and heat.

CRITERIA FOR QUANTITY DISTANCE TABLE 1A1–4 IN APPENDIX 1

Fixed distances

64. **D = 2 m.** The D = 2 m distance is used, providing virtually complete protection, for all side or rear-on earth-covered ES, regardless of PES, and when the PES is a side or rear-on earth-covered building and the ES is a face-on earth-covered building with protective door and headwall or a heavy walled building with protective roof.

65. **Explanation.** To be issued.

66. **D = 10 m.** The D = 10 m distance is used, providing either virtually complete or high/limited degree of protection, where the PES is a heavy walled building with or without protective roof, or an open stack or light structure with or without traverse, and the ES is a face-on earth-covered building, or a traversed open stack, or light structure.

67. **Explanation.** To be issued.

68. **D = 25 m.** The D = 25 m distance is used as alternative to or in place of the 10 m fixed distance when resistance of headwall and door of an earth-covered building or other form of ES is inadequate. It is also used as workshop distance where the workshop is a traversed heavy walled building with protective roof.

69. **Explanation.** The D = 25 m distance is known as the fire fighting distance, and prevents ignition of buildings and stacks by radiant heat. UK and US trials with propellants in buildings designed to vent through the door end show that the contents of the buildings are thrown through the front only.

70. **D = 60 m.** The D = 60 m distance is used as an alternative to or in place of the 25 m distance when construction or orientation of the PES/ES is considered to be inadequate. It is also used as workshop distance where the workshop does not have a protective roof and/or a traverse, and as fixed PTRD when traffic can be stopped promptly.

71. **Explanation.** The D = 60 m distance is based upon French (Burlot's) trials. It is the minimum distance from a PES containing HD 1.3 items, other than propellants.

Distance functions

72. D4–distance:

$D4 = 6.4\ Q^{1/3}$

D4–distances are used as IBD with a minimum of 60 m.

73. **Explanation.** The D4–distance function is based upon UK trials with propellants and is derived from UK formula $D = 16\ W^{1/3}$. The distances protect against flame and heat.

**APPENDIX 3 TO
ANNEX A**

OVERPRESSURE - K-FACTOR CONVERSION CHART

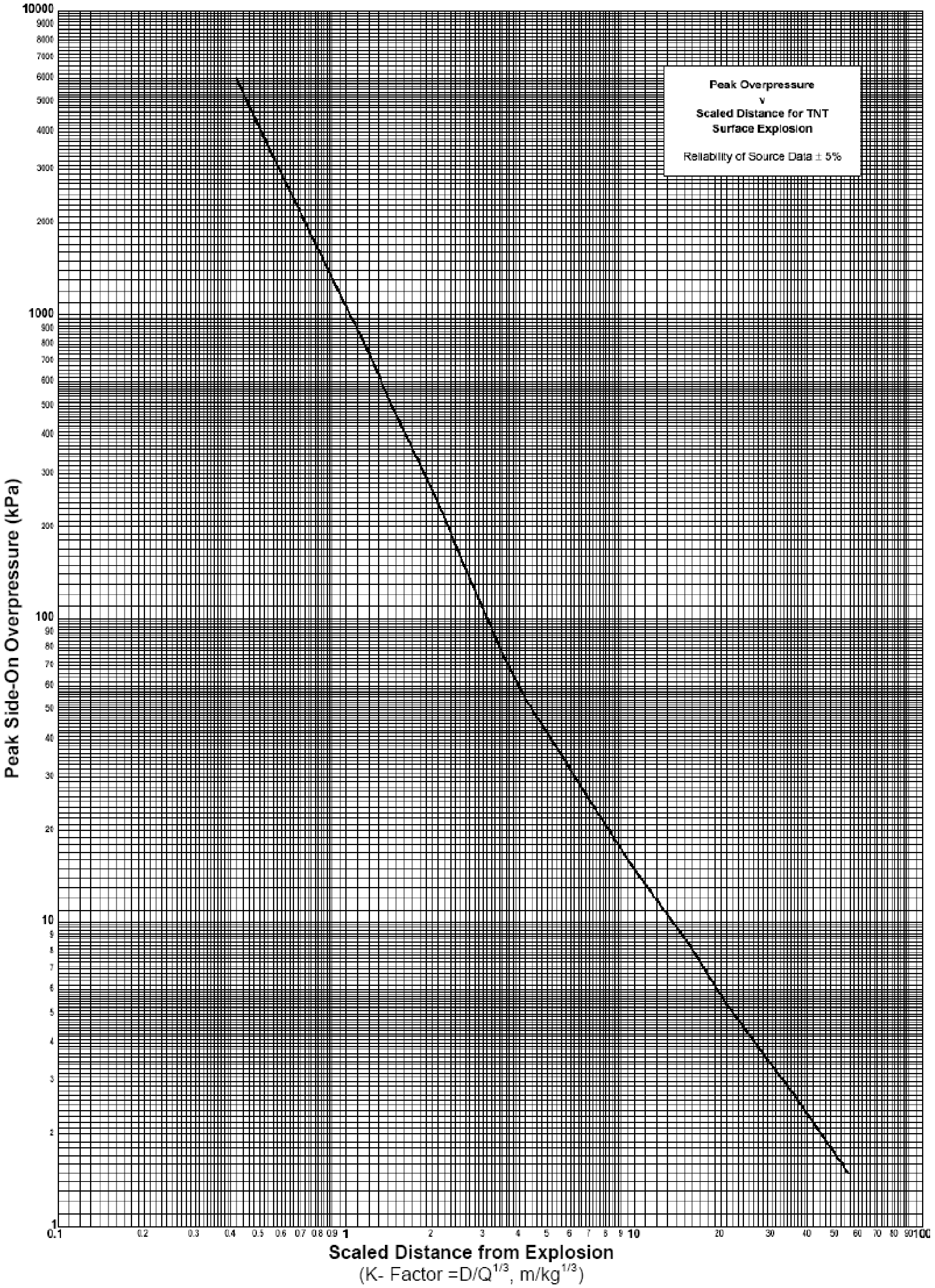

Figure 4A3-1: Overpressure – K-Factor Conversion Chart

APPENDIX 4 TO ANNEX A

EQUIVALENT OVERPRESSURE VALUES TO GIVE DEFINED BLAST DAMAGE DESCRIPTIONS

The damage values listed below have been collected from many different sources and selected/adjusted to form a logical and consistent series. Damage values found in various references could be somewhat different to those given here due to different interpretations of the assessment of blast damage values. The listed values are suitable for work on accidental explosions where equivalent TNT type damage assessments are used. The values are approximate and relate to conditions of unsheltered exposure and no blast reflection effects with the lower end of a band applying to large explosions and the upper end to small explosions

Damage Details	Incident Equivalent Peak Overpressure in (kPa (psi)
Effects on Persons	
Ears	
Sound Noted as an unusual event – an explosion	0.035 (0.005)
Loud noise at 143 dB	0.3 (0.045)
Annoying noise of continuous type at 10-15 Hz and 137 dB	0.1 (0.015)
Threshold for temporary loss of hearing	1.3 (0.2)
Threshold for eardrum rupture	13 (2)
50% eardrum rupture	33 (4.8)
50% probability of eardrum rupture	34 – 48 (5 – 7)
90% probability of eardrum rupture	68 – 103 (10 – 15)
Wounds	
Minimum for penetration injury by small glass fragments	5 (0.8)
Threshold of skin laceration by missiles	6 – 13 (1 – 2)
Serious missile wounds of about 50% fatality	27 – 34 (4 – 5)
Serious missile wounds of near 100% fatality	48 – 68 (7 – 10)
External Injury	
Low personnel risk when inside a resistant structure	6 (1)
Personnel knocked down or thrown to ground	10 – 19 (1.5 – 2.9)
Possible death by persons being projected against obstacles	13 (2)
People standing up will be thrown a distance	55 – 110 (8 – 16)
People lying flat on the ground are picked up and hurled about	82 – 165 (12 – 24)
Internal Injury	
Threshold of internal injuries	48 (7)
Threshold of lung haemorrhage	82 – 103 (12 – 15)
50% fatality from lung haemorrhage	137 – 172 (20 – 25)
99% fatality from lung haemorrhage	206 – 241 (30 – 35)
Immediate blast fatalities	482 – 1378 (70 – 200)
Primary Missiles	
General	
Limit of travel of primary missile	0.8 – 1.3 (0.12 – 0.20)
Missile limit (negligible effects beyond this range)	2 (0.3)
Damage to Buildings	
Glass Failure	
Exceptional cases of large windows already under strain failing	0.1 (0.015)
Occasional breakage of large glass windows already under strain	0.2 (0.03)
Sonic boom glass failure	0.2 (0.03)
Breakage of small windows under strain	0.6 (0.1)
Typical pressure for glass failure	1 (0.15)
Large and small windows usually shattered, occasional damage to	

window frames	3 – 6 (0.5 – 1.0)
5% of exposed glass panes broken	0.1 – 0.2 (0.015 – 0.03)
10% of exposed glass panes broken	0.2 – 0.3 (0.03 – 0.045)
25% of exposed glass panes broken	0.3 – 0.6 (0.045 – 0.10)
50% of exposed glass panes broken	0.5 – 1.3 (0.08 – 0.19)
75% of exposed glass panes broken	1 – 2.4 (0.15 – 0.35)
90% of exposed glass panes broken	1.7 – 4.1 (0.26 – 0.60)
99% of exposed glass panes broken	4.6 – 11 (0.67 – 1.6)
Double glazing is generally twice as strong as normal single glazing when glass panes of equal thickness	X 2 glass values
Damage to Houses – General	
House roof tiles displaced	2 – 4 (0.38 – 0.64)
Minor damage to house structures	4 (0.7)
Partial demolition of house – rendered uninhabitable	6 (1)
Partial collapse of walls and roofs of houses	13 (2)
Nearly complete destruction of houses	34 – 48 (5 – 7)
Damage to Buildings – General	
Limited minor structural damage	2 – 2.7 (0.3 – 0.4)
Doors and window frames may be blown in	5.3 – 8.9 (0.77 – 1.3)
‘Safe Distance’ (only 5% probability of serious damage beyond this value)	2 (0.3)
Limit of earthshock damage	8 (1.2)
Boarding panels on roofs torn off	10 (1.5)
Lower limit of serious structure damage	13 – 20 (2 – 3)
Moderate damage to massive, loadbearing wall type multistorey buildings	41 – 48 (6 – 7)
Probable total destruction of buildings	68 (10)
UK Brick Built Houses	
Category ‘D’ Damage – Inhabitable, but require repairs to remedy serious inconveniences. Damage to ceilings, roof tiling, roof battens and roof coverings, minor fragmentation effects on walls and more than 10% glass broken	1.7 – 5.1 (0.25 – 0.75)
Category ‘Ca’ Damage – Uninhabitable, but repairable. Not more than minor structural damage with partitions and joinery wrenched from fixings	6 – 12 (1 – 1.8)
Category ‘Cb’ Damage – Uninhabitable until extensive repairs are made (ie partial or total collapse of roof structure, partial demolition of 1 or 2 external walls – up to 25% of the whole - severe damage to load bearing partitions)	34 – 58 (5 – 8.5)
Category ‘B’ Damage – Badly damaged beyond repair (ie 50% to 75% of the external brickwork destroyed or, with less damage, the remaining walls have gaping cracks rendering them unsafe)	
Category ‘A’ Damage – Completely demolished (ie with over 75% of external brickwork demolished)	68 – 182 (10 – 26.5)
50% destruction of brickwork	27 – 48 (4 – 7)
US Typical Houses	
Minor damage to glass or miscellaneous small items (similar to that resulting from high wind)	3 – 7 (05 – 1.1)
Fastening of wood panels for standard wood housing fail with panels blown in	6 – 13 (1 – 2)
Slight damage; doors, sashes or frames removed, plaster and wallboard broken, singles or siding off	13 – 19 (1.9 – 2.9)
Moderate damage; walls bulged, roof cracked or bulged, studs and rafters broken	15 – 24 (2.2 – 3.5)
Severe damage; standing, but substantially destroyed, some walls gone	27 – 32 (4 – 4.7)
Demolished, not standing	68 – 117 (10 – 17)

APPENDIX 4 TO ANNEX A

Miscellaneous	
Industrial	
Corrugated asbestos sheets shattered	6 – 13 (1 – 2)
Failure of joints or fastenings in aluminium or steel panels followed by buckling	6 – 13 (1 – 2)
Steel frame of clad building slightly distorted	8 – 10 (1.2 – 1.5)
Collapse of steel panel construction	19 – 24 (2.9 – 3.6)
Building steel frame distorted and pulled away from foundations	20 (3)
Cladding of light industrial building demolished	27 (4)
Frameless steel panel building demolished	20 – 27 (3 – 4)
Movement of bridge members on abutments and some distortion of bridge members	34 – 103 (5 – 15)
Road Vehicles	
Cars and displaced with trucks blown over with frames sprung	55 – 82 (8 – 12)
Severe damage to cars and trucks	137 – 206 (20 – 30)
Rail Vehicles	
Superficial damage to rail wagons	17 – 31 (2.5 – 4.6)
Rail wagons damaged, but easily repairable	37 – 79 (5.5 – 11.5)
Bodywork of rail wagons crushed	57 – 137 (8.4 – 20)
Empty rail box cars blown off tracks by side on loading	37 – 41 (5.5 – 6.0)
Empty 50 ton rail tank car blown off tracks by side on loading	44 – 46 (6.4 – 6.7
Loaded train wagons overturnec	48 – 51 (7 – 7.5)
Loaded 50 ton rail tank car overturned by side on loading	55 (8)
Loaded rail box cars completely demolished	62 (9)
Steel towers blown down	206 (30)
Displacement of rail ballast and rail movement	641 – 1413 (93 – 205)
Aircraft	
Damage to control surfaces and other minor aircraft damage to aircraft	7 – 14 (1 – 2)
Major damage – DLM effort to restore aircraft	14 – 24 (2 – 3.5)
Total destruction of aircraft	24 (3.5)
Trees	
Some minor damage to branches of trees	6 – 10 (1 – 1.5)
Trees – leaves and branches blown off, but very few large trees blown down	11 – 15 (1.7 – 2.3)
About 30% large tree blown down, remainder having many leaves and branches blown off	16 – 25 (2.4 – 3.7)
90% of large trees blown down	24 – 41 (3.5 – 6.0)

Table 4A4–1: Equivalent Overpressure Values to Give Defined Blast Damage Descriptions

ANNEX B

QUANTITY DISTANCES FOR ABOVE GROUND OPEN STACKS/BUFFERED STORAGE

Purpose

1. This chapter describes special storage configurations which may be used in the above- ground storage of Explosive Ordnance (EO). These configurations are for the storage of shell in open stacks and buffered storage for the storage of bombs.

Storage in open stacks

2. The storage of shell in open stacks is described in Regulation 5.4 Annex A—'Quantity distances for above-ground storage of explosive ordnance', paragraph 74. The special types of projectiles and the conditions for this type of storage are as follows:

a. The projectiles for storage in open stacks should be filled only with TNT, IHE (F of I <TNT) or Amatol. RDX/TNT is unsuitable.

b. The projectiles should have walls generally similar to the 155 mm M107 and the 8 inch Howitzer projectiles as regards robustness and ability to withstand fragment attack. In particular, projectiles with thin noses (HESH or HEP) are unsuitable for storage in open stacks.

c. The projectiles must be unfuzed and should be fitted with cavity plugs of a substantial design. The thickness of the plug must be at least 25 mm.

d. Each stack should be restricted to 6800 kg Net Explosives Quantity (NEQ) and to no more than 1000 projectiles.

e. The projectiles in a stack should be arranged with axes parallel and noses in the same direction.

f. The separation of adjacent stacks of the maximum size should be 1.3 m between nearest parts (nose-plug rings or projectiles' bases). The separation of smaller stacks should be that indicated in figure 2–1. Adjacent stacks may present the projectiles either nose-to-nose or base-to-base, but not nose-to-base, nor vice versa.

g. At the ends of each stack the side-walls of projectiles will be exposed. These side- walls are relatively vulnerable to attack by fragments from another stack. Care must be taken to ensure that the arrangement of the stacks on a site (module) or in a building provides adequate protection against the risk of propagation by this means. One method is to ensure that all stacks are parallel and have the same dimensions, thus forming a rectangular arrangement. Another method is to use the walls of the storage building or the traverse to protect the ends of stacks. A third method is to observe the D9–distances given in Regulation 5.4 Annex A, Appendix 1, table 1A1–1 but such a large separation is rarely practical.

h. Stacks should be restricted to open sites (modules) with minimal weather protection or to above-ground buildings with walls and roofs of light construction. Exceptionally, existing buildings with light roofs but solid walls may be used provided that these solidly constructed walls do not exceed 3 m in height. The stacking technique is based on United States and United Kingdom tests in the open air and is not necessarily valid in an earth-covered building or an underground storage site which imposes a much greater confining effect

i. An accidental explosion of one stack would scatter and disarrange the neighbouring stacks thus destroying the critical geometry upon which this stacking technique relies. To minimise any risk of subsequent fires which could cause the 'cook-off' of one of these disarranged projectiles, and the resultant mass explosion of many other projectiles, softwood should be avoided in any pallets and dunnage. Combustible materials should be avoided as far as possible in the structure of a building used for such stacks.

j. The total NEQ on a storage site (module) or in a building should be restricted to 110 000 kg.

k. Each module or building should be surrounded by a traverse substantially of earth. This may be the double-slope type or the single-slope with one vertical wall type. The foot of the traverse should be not less than 2.4 m from the nearest stack. In establishing the height of the traverse the 2° rule should be observed (see Regulation 6.1, Procedure 2).

l. Where adjoining modules or buildings are separated by a shared traverse, the thickness of the traverse together with the distances from the stacks to that traverse are considered to provide adequate protection. Normal inter-magazine distances do not apply.

m. The minimum process building distance is 150 m in the case of traversed workshops with protective roofs. Workshops without such protection should not be sited within the zone of severe debris risk, deemed to be the sectors lying within 30° on each side of those sides of the module or building which are parallel to the projectiles and extending to a distance of 600 m. Outside this zone, unprotected EO workshops should be sited in accordance with Regulation 5.4 Annex A, Appendix 1, table 1A1–1.

n. A minimum inhabited building distance and public traffic route distance of 600 m should be observed because of the severe risk from numerous whole projectiles likely to be projected from the upper tiers of stacks near an exploding stack. Such projectiles are not expected to explode upon impact but present a serious debris hazard. This debris would be projected all at once and possibly without warning, unlike explosions involving EO of Hazard Division (HD) 1.2 where there usually is time for evacuation.

Buffered storage

3. The storage of bombs using the buffered storage concept is briefly described in Regulation 5.4 Annex A, paragraphs 75–76. This concept can be used in all types of above-ground storage facilities. The special conditions for this type of storage are as follows:

a. The geometry of bomb and buffer stacks is critical and must be maintained at all times. The buffer stack must preclude any direct line of sight between stacks of bombs.

b. Vertical and horizontal offsets of rows and columns of containers in the buffer stacks are to be used to prevent alignments of the containers which would allow line of sight spaces through which fragments of a detonating bomb stack could pass unimpeded to the other stack of bombs in storage.

c. Bombs must be orientated nose-to-nose in those portions of the stacks which face each other. Metal nose and tail plugs must be used in all bombs.

d. In computing the maximum amount of explosives which could be involved in an accidental explosion in a buffered storage arrangement, HD 1.4 EO is not to be included in the NEQ.

e. The largest stacks of Mk 82/84 bombs authorised for buffered storage are 27 000 kg NEQ. Bomb stacks are to be separated by a minimum of 11.6 m.

Note

In using this concept with Mk 82/84 bombs extreme care must be taken in determining the specific arrangement and types of buffer material.

ANNEX B

f. When otherwise authorised, inert material or HD 1.4 EO may be stored in the same structure or facility where buffered storage is in use.

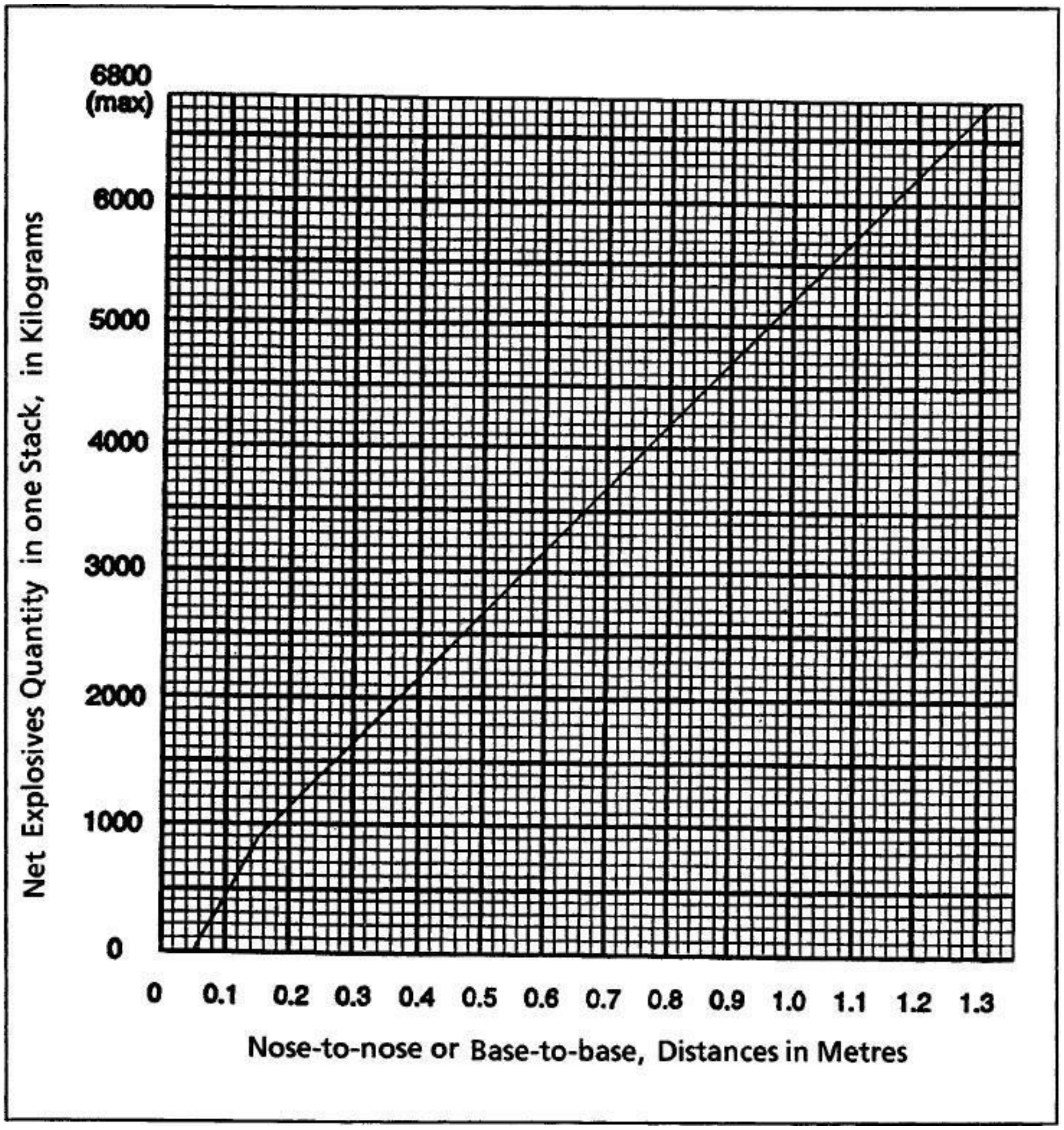

Figure 4B-1. Minimum separation of adjacent stacks of certain projectiles

ANNEX C

QUANTITY DISTANCES FOR PETROL, OIL AND LUBRICANT FACILITIES WITHIN MILITARY INSTALLATIONS

Introduction

1. The criteria specified in this chapter for the separation of Petrol, Oil and Lubricants (POL) from Explosive Ordnance (EO) facilities are intended primarily for use in determining separations at large permanent explosive ordnance storage depots. For basic load sites, missile sites and similar small tactical installations, it may be desirable to weigh the cost of distance/protective construction against the strategic value of the POL supplies and the ease of replacement in the event of an incident. Reduced distances may be approved if the POL loss can be accepted, and if the POL facilities are sited so as not to endanger the EO.

2. The separation distances prescribed are not applicable to roads or rail lines along which EO may pass. Such risks can be regarded as transient and a nominal 15 m separation distance is to apply. Holding facilities on roads or elsewhere licensed for the parking of vehicles carrying EO should however, be treated as Potential Explosion Sites (PES) and the appropriate separation distances applied as prescribed below.

3. There may be mutual hazards created by siting POL installations and facilities close to a PES. The hazards from the POL to the PES must be considered as well as the hazard to the POL from the EO.

4. POL installations should be constructed at the Outside Quantity Distance (OQD). Where the construction of installations within the OQD of EO areas or facilities is unavoidable, the conditions detailed below are to be observed.

Small quantities of petrol, oil and lubricants

5. Small quantities of POL, ie up to 200 litres, held in storage tanks for small heating plants and POL for daily use in mechanical handling and similar equipments do not require a specific distance for protection from an EO site.

Unprotected above-ground petrol, oil and lubricant tanks, drums and pipelines

6. Unprotected above-ground POL steel tanks and drums are to be separated from PES by Inhabited Building Distances (IBD) given in the Quantity Distance (QD) tables in Regulation 5.4 Annex A Appendix 1. Minimum distances given in the QD tables for Hazard Division (HD) 1.1 are to apply and for HD 1.2 the selection of QD is not to assume any special firefighting arrangements.

7. A minimum separation of 25 m is required to unprotected above-ground POL pipelines, where stop-cocks are fitted to the pipeline, otherwise apply the distances in paragraph 6.

8. Where unprotected above-ground POL facilities are vital, IBD, with a minimum of 450 m, must be observed from PES for EO of HD 1.1 and 1.2.

Protected above-ground petrol, oil and lubricant tanks, drums and pipelines

9. QD less than those for unprotected POL facilities may be used where a surface storage tank or drum storage area is provided with heavy structural protection against blast and fragment penetration. For purposes of applying this paragraph, ‘protected’ means that the POL storage tank or drum as an Exposed Site (ES) is provided with structural protection equivalent to the storehouses and workshops shown in the ES column, rows 1–8, 12 and 13 of Regulation 5.4 Annex A Appendix 1, table 1A1–1. When this degree of protection is afforded, the minimum distance from EO in HD 1.1 is to be at least 1.2 $Q^{1/3}$ with a minimum of 25 m. In no case should the distance be less than 25 m from buildings or stacks containing EO of HD 1.2, 1.3 and 1.4.

ANNEX C

Separation of underground petrol, oil and lubricant tanks and pipelines

10. Underground POL tanks and pipelines should be separated from buildings or stacks containing EO of HD 1.2, 1.3 and 1.4 by a minimum distance of 25 m. The distances from EO in HD 1.1 are to be at least 1.2 $Q^{1/3}$ with a minimum distance of 25 m.

Temporary storage of petrol, oil and lubricants within explosive ordnance area

11. In emergencies the officer-in-charge of an establishment may authorise, in writing, the temporary storage (for a period not exceeding 36 hours) of POL stocks in the EO area. The conditions of storage are to be such that a fire in the POL will not hazard any individual EO site.

ANNEX D

QUANTITY DISTANCES FOR MISSILE INSTALLATIONS

General

1. The Quantity Distance (QD) principles for missile installations are essentially the same as those given in Regulation 5.4 Annex A—'Quantity distances for above–ground storage of explosive ordnance'. These distances however, do not cater for the inadvertent launch of a missile. Each missile installation is treated as a Potential Explosion Site (PES) requiring Inside Quantity Distances (IQD) and Outside Quantity Distances (OQD) as given in Regulation 5.4 Annex A. Judgment should be used to associate the missile installation with an appropriate pictograph for a PES taking account of the particular design.

Potential explosion sites

2. Launching platforms, warheading buildings, ready-round storage areas and other facilities where the missile with warhead is serviced or stored are considered to be PES containing EO of Hazard Division 1.1.

3. The 'Definitive Drawings' for a missile installation should include the separation distances necessary to prevent propagation of explosion. Where operational requirements for the missile system necessitate smaller distances, the PES are aggregated and considered to be one PES as regards OQD.

Exposed sites

4. Military sites such as operation centres, readiness structures, radar and communication installations, fuel stations, parking areas and guard shelters may be considered to be Exposed Sites (ES) which are protected by the appropriate IQD. These ES may be inside the missile installation under consideration or inside another military installation.

5. The 'Definitive Drawings' for a missile installation are based on operational requirements which may override the IQD and which must be taken into account by additional infrastructure measures such as site safety plans.

6. An ES outside a missile installation, not being inside another military installation, must be protected by the OQD given in Regulation 5.4 Annex A.

Measuring of quantity distances

7. QD at launcher platforms are measured from the extremities of the missile(s) when in normal position on the platform. As regards assembly buildings and storage sites at a missile installation, the normal procedure in Regulation 5.4 Annex A, paragraphs 1.52–3 applies.

Net explosives quantity

8. The normal procedure for computing the Net Explosives Quantity (NEQ) applies, see Regulation 5.4 Annex A, paragraphs 1.54–8. Information, which may be classified, on the effective NEQ of a particular type of missile should be obtained from the design authority. Otherwise, the actual NEQ must be calculated in accordance with the definition in the Glossary of Terms and Regulation 2.2 Procedure 1—'Determination of the net explosives quantity'.

ANNEX E

QUANTITY DISTANCES FOR BASIC LOAD EXPLOSIVE ORDNANCE HOLDING AREAS

General

1. Certain units must keep their basic load of Explosive Ordnance (EO) in readiness within the boundaries of their barracks or in the immediate vicinity thereof. This requires deviations from the Quantity Distance (QD) standards in Regulation 5.4 Annex A—'Quantity distances for above–ground storage of explosive ordnance'. A higher level of risk must be accepted in relation to Inside Quantity Distances (IQD), otherwise the units cannot fulfil their mission. The Outside Quantity Distances (OQD) however, are not reduced. Such areas are to be utilised only with the authority of the appropriate licensing authority.

2. The following QD standards apply to locations where combat units hold their basic load EO in armoured vehicles[1], trucks, trailers, structures or on pads. Such locations are described in this manual as basic load EO holding areas.

3. It is emphasised that the QD given in this chapter are the minimum, and that greater QD should be observed wherever practicable in order to provide a higher degree of safety.

Mixing of basic load explosive ordnance of different hazard division and compatibility groups

4. EO in Hazard Division (HD) 1.1 and 1.2 in a basic load EO holding area is regarded as HD 1.1 EO as aggregation rules still apply. All components necessary for complete rounds of artillery, mortar and rocket EO may be stored together without regard to compatibility. Complete rounds of EO of all compatibility groups may be stored together within heavy armoured vehicles.

Net explosives quantity

5. Normally the total Net Explosives Quantity (NEQ) of EO in a single site is used for the computation of QD. For the exclusion of propelling charges from the computation, see Regulation 5.4 Annex A, paragraphs 57-61. In the case of basic load EO holding areas, it is also permitted to exclude from the computation the NEQ of EO in HD 1.3, unless this is the only EO at a site in which case tables 1A1–3 and 1A1–4 of Regulation 5.4 Annex A Appendix 1 apply. The maximum NEQ at any site in a basic load EO holding area must not exceed 4000kg.

6. **NEQ of armoured vehicles.** The total NEQ of EO in each single vehicle (heavy or light) is used for the computation of QD.

7. **NEQ of trucks and trailers.** The total NEQ of EO in each truck or trailer is used for the computation of QD, provided that each truck or trailer is separated from every other one by at least the BD1–distances in table 4E–1, if traversed, or BD3–distances, if untraversed.

8. **NEQ of vehicle parks.** If the trucks or trailers within a park are not separated from each other by QD specified in paragraph 7, the total NEQ of EO in all trucks or trailers within a truck park or trailer park is to be used for the computation of QD.

Separation of vehicle parks

9. Figure 4E–1 demonstrates an example of the layout of a typical vehicle park. The BD–distances refer to the columns in table 4E–1. It is permissible to park both trucks and trailers in a single park.

[1] Armoured vehicles includes both heavy and light

ANNEX E

Separation of armoured vehicles

10. Armoured vehicles containing basic load EO are separated from each other by a minimum distance of 2m in all directions, regardless of the quantity of EO within the vehicle. This separation distance is required for manoeuvring of the vehicles, and is not based on explosives safety considerations.

Separation of trucks and trailers

11. Trucks and trailers containing basic load EO are separated from each other by the BD3–distances in table 4E–1.

Storage in earth-covered structures of basic load EO

12. Sometimes it may be possible to place basic load EO in earth-covered structures in unit load configurations which permit rapid loading of vehicles. When standard igloos are used, separation distances given for HD 1.1 EO apply (see Regulation 5.4 Annex A, Appendix 1 table 1A1–1). When earth-covered shelters of light construction are used, the BD1–distances in table 4E–1 apply to the side-to-side configuration, provided that the earth-cover complies with Regulation 5.4 Annex A, paragraph 124, and the EO is stored at least 1m from the end of the shelter. If end-to-end exposures are involved, the BD2–distances in table 4E-1 apply, provided that there is a traverse (see Regulation 5.4 Annex A paragraphs 113-127).

Outside quantity distances

13. **OQD from vehicles with heavy armour.** For vehicles with heavy armour, the BD6– distances in table 4E–1 are used both as Public Traffic Route Distances (PTRD) and, as Inhabited Building Distances (IBD). It can be assumed that heavy armour may contain fragments, and may therefore be considered an effective traverse. The BD6–distances are based on blast overpressure effects only.

14. **OQD from vehicles with light armour.** For vehicles with light armour, the BD4 and BD5–distances in table 4E–1 are used as PTRD and IBD respectively, since light armour may not be capable of containing fragments.

15. **OQD from trucks and trailers.** For trucks and trailers, the BD4 and BD5–distances in table 4E–1 are used as PTRD and IBD, respectively. Barracks, headquarters and maintenance facilities within a military installation should be separated in all cases from trucks and trailers by BD5– distances. If BD5-distances are achievable due to operational requirements and limitations of real estate, lesser distances may be utilised provided these have been appropriately authorised by the licensing authority.

Location of basic load vehicles within explosive ordnance facilities

16. Location of basic load EO within EO storage and pre-load facilities or depots is essential in order to preclude the possible loss of large stocks of EO. Therefore, the licensing authority must assess carefully such a proposal before granting a special authorisation for basic load vehicles.

Forward Arming and Refuelling Point

17. **General.** The storage of EO and fuel at the same location is inherently hazardous and should be avoided when possible. If it is necessary to refuel and rearm aircraft at the same location, i.e. at a Forward Arming and Refuelling Point (FARP), all precautions must be made to minimise the hazards involved in these operations. Compliance with this regulation and Aviation Maintenance Management Manual (eAMMM) AAP 7001.059 Section 3 Chapter 10 and its Annex is mandatory.

Note:

A FARP training or exercise activity conducted outside a declared Defence Training or Practice Area or range is required to be licenced by the Licensing Authority in accordance with Regulation 5.4 Annex F.

18. **Required Separations.** FARP are to be separated by BD5-distances from all non- associated inhabited buildings. The ready-use EO storage, i.e. the EO staged to support the next aircraft loading, is to be separated by BD1-distances, even if untraversed, from the armament pads, with only armament pads considered as the PES. Ready-use EO storage structures and locations are to be separated from other ready-use EO storage structures and locations by BD1 (traversed) or BD3 (untraversed) distances. EO Preparation Areas, e.g. for fuzing or linking of ammunition, are to be separated by BD1 (traversed) or BD3 (untraversed) distances from all other EO storage and operations with only the EO Preparation Areas considered as the PES. Figure 4E-2 shows a schematic layout of a typical FARP. The BD–distances refer to the columns in table 4E–1.

19. **Asset Preservation.** The prescribed BD1 (traversed) or BD3 (untraversed) distances provide reduced operational protection only. If greater protection from the FARP to other exposed sites is required, the asset preservation quantity distances of $D = 12Q^{1/3}$, are applied to the assets concerned.

20. **Fuel Storage.** EO is to be separated from operational fuel supplies by at least 30m. Fuel supplies are to be bunded or placed downhill from the EO.

21. **Armament Pads.** Armament pads are to contain the minimum amount of EO to conduct efficient operations. For example, where armament pads support only one aircraft, that pad will be restricted to the amount of EO necessary to rearm that aircraft.

Missile installations

22. Basic load EO holding areas are separated from strategic missile installations by BD5–distances in table 4E–1, unless special operational requirements demand other distances (see Regulation 5.4, Annex D - 'Quantity distance principles for missile installations').

ANNEX E

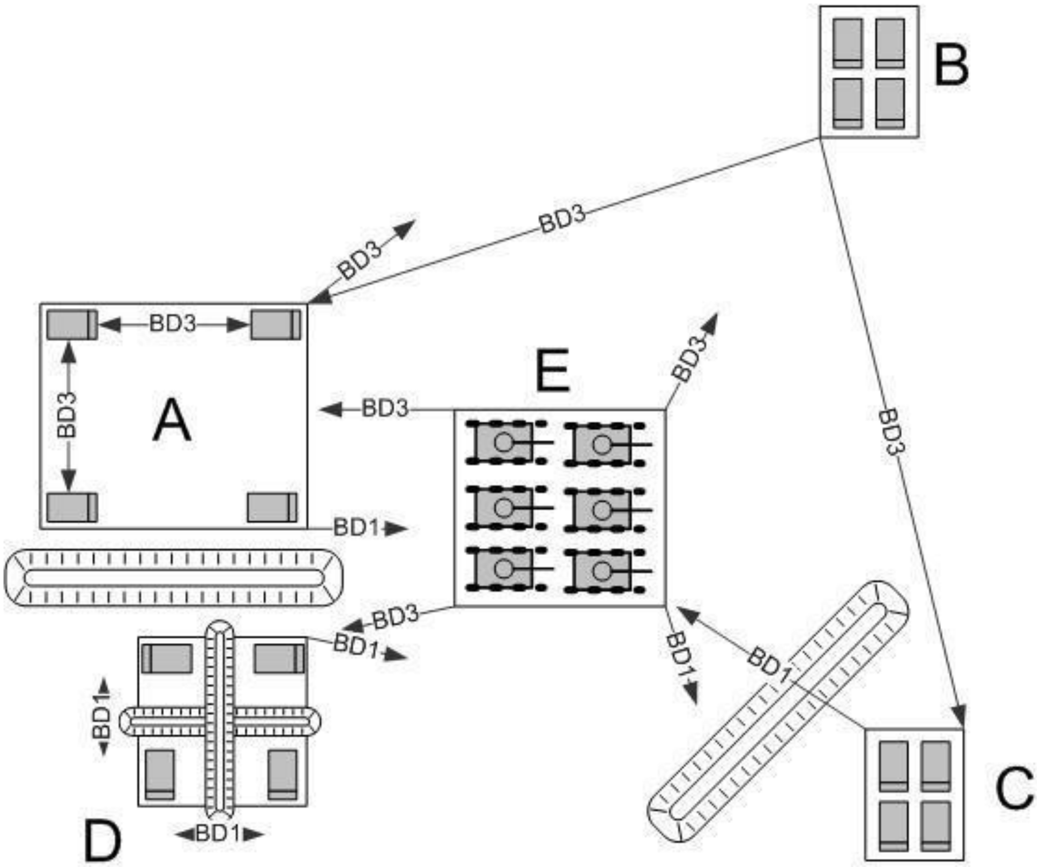

Figure 4E-1: Separation of basic load vehicle parks

Note

(a) A, B, C and D are parks for trucks and trailers, each vehicle containing Q_1 kg NEQ. E is a park for light or heavy armoured vehicles, each containing Q_2 kg NEQ. Every vehicle and park is considered in turn as a Potential Explosion Site (PES).

(b) In Park A, the vehicles are untraversed but are separated by BD3–distances in table 4E–1. Hence the IQD and OQD from this park are based on Q_1 only.

(c) In Park B, the vehicles are untraversed and closer together than BD3–distances in table 4E–1. Hence the IQD and OQD from this park are based on $4Q_1$.

(d) In Park C, the effective NEQ is $4Q_1$. The traverse between Park C and Parks D and E permits BD1–distances in table 4E–1 to be used from this park in the direction of Park D or Park E.

(e) In Park D, the individual trucks and trailers are traversed and separated by BD1–distances in table 4E–1. Hence the IQD and OQD from this park are based on Q_1 only.

(f) In Park E, the vehicles are separated by at least 2 m. The IQD from this park is BD1 or BD3 based on Q_2 only. Park E is deemed to be a traversed PES when the armour is heavy; light armour however, cannot contain all fragments.

(g) When Park E is considered as an exposed site, it is always deemed to be traversed since the light or heavy armour is capable of excluding fragments.

(h) The relative size of the IQD depends on the values or Q_1 and Q_2 and the number of trucks and trailers which are aggregated. The optimum layout balances the numbers of vehicles and parks against the availability of land and earth for traverses.

ANNEX E

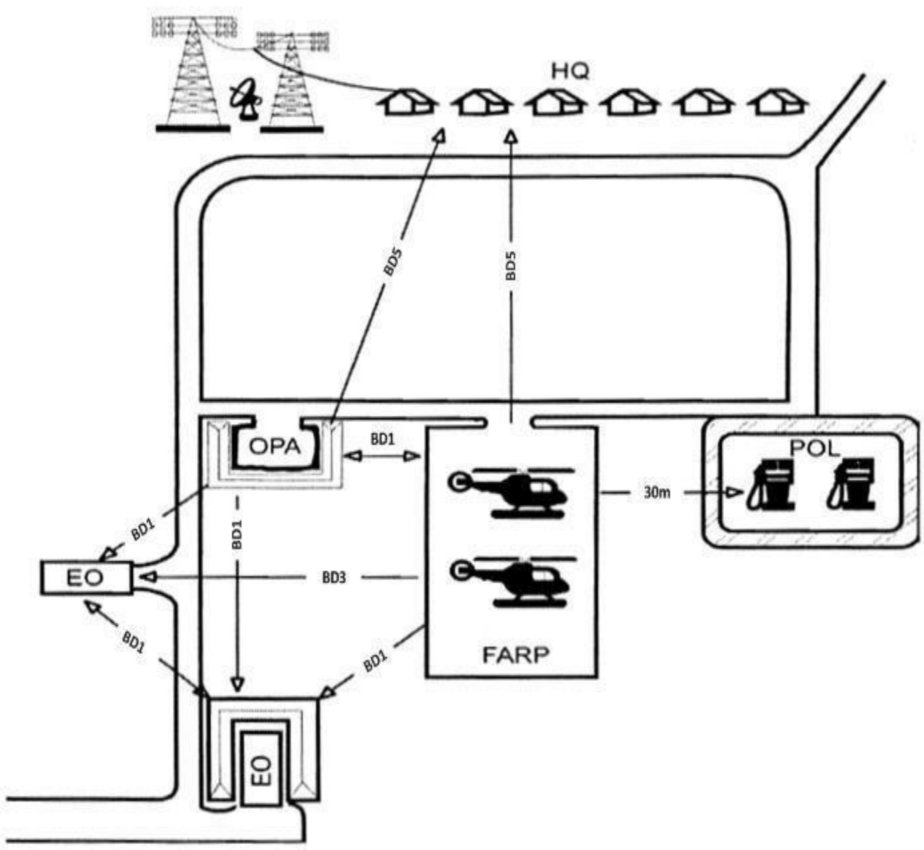

Figure 4E-2: Typical Separation of Forward Arming and Refuelling Point to Other Facilities

Note:

(a). Aggregate the NEQ on the FARP when treating as a PES.

(b). Aggregate the NEQ for the Ordnance Preparation Area when treating as the PES.

(c). To protect facilities and important assets, use $D = 12Q^{1/3}$ (BD5 is thegreater).

ANNEX E

Net Explosives Quantity (NEQ) in kg	**Quantity distances in metres**					
	BD1	**BD2**	**BD3**	**BD4**	**BD5**	**BD6**
50	3	7	18	180	270	20
75	3	8	21	180	270	27
100	4	8	23	180	270	32
125	4	9	24	180	270	38
150	4	10	26	180	270	42
175	4	10	27	180	270	
200	5	11	28	180	270	
250	5	11	31	180	270	
300	5	12	33	180	270	
350	6	13	34	180	270	
400	6	13	36	180	270	
450	6	14	37	180	270	
500	6	14	39	180	270	
600	7	15	41	180	270	
700	7	16	43	180	270	
800	7	17	45	180	270	
900	8	17	47	180	270	
1000	8	18	48	180	270	
1200	9	19	52	180	270	
1400	9	20	54	180	270	
1600	9	21	57	180	270	
1800	10	22	59	180	270	
2000	10	23	61	180	270	
2500	11	24	66	185	275	
3000	12	26	70	205	305	
3500	12	27	73	220	330	
4000	13	29	77	235	350	
Distance Functions	BD1 = $0.8Q^{1/3}$	BD2 = $1.8Q^{1/3}$	BD3 = $4.8Q^{1/3}$	BD4 = $3.6Q^{1/2}$	BD5 = $5.5Q^{1/2}$	BD6 = $1.5Q^{2/3}$

Table 4E-1: Quantity Distances for Basic Load Explosive Ordnance Holding Areas

ANNEX F

QUANTITY DISTANCES FOR AIRFIELDS

General

1. Instructions for the storage of Explosive Ordnance (EO) on a long-term basis within EO facilities, in a properly sited EO storage area, have evolved over many years. However, when considering the EO activities conducted outside EO storage areas on airfields, it is often impossible to apply the ‘standard’ Quantity Distance (QD) criteria prescribed in Regulation 5.4 Annex A, because of airfield layout and operational considerations. Furthermore, where these QD could be achieved, they would in many instances impose unacceptable constraints on a unit’s ability to fulfil its task.

2. To meet operational and training requirements, it is clearly necessary to remove EO from the relative safety of the storage area and position the EO on or near aircraft, usually for short periods of time. However, because of the threat to airfields from air attack and sabotage, it has become essential also to consider storing EO as close to aircraft as possible, without exposing personnel, aircraft, weapons and vital facilities to an unacceptable level of risk from explosion either by accident or enemy action.

3. Accordingly, the QD and other quantity distance criteria[1], ie Aircraft (Quantity) Distances (AD), prescribed in this instruction represent a compromise between absolute safety and the practical considerations of cost and operational requirements. These quantity distances provide the minimum degree of protection required for the storage, loading and unloading of EO on airfields, depending on whether they are military use only or joint military/civilian use (joint–user) airfields. Operational commanders at Force or Force Element Group (FEG) level are also offered further choices of quantity distance criteria, which may enhance operational posture but at the cost of increasing the risk.

Purpose

4. This instruction prescribes the safety requirements and quantity distance criteria applicable to EO loaded aircraft and the storage and handling of EO outside of designated EO storage areas on military or joint–user airfields.

Applicability

5. This instruction applies to airfields, whether on Australian soil or not:

a. used by military aircraft only; or

b. used jointly (by agreement or contract on a temporary or permanent basis) by military, civilian and/or foreign military aircraft, noting that this concept of joint use expands upon the definition of ‘joint-user airfields’ under the Airports Act 1996 which defines ‘joint-user airfields’ to be Darwin, Townsville and Canberra airfields only. The additional requirements of paragraphs 49 and 50 apply to airfields used jointly by military and civil aircraft.

6. The layout of all EO facilities for new airfields are to accord with the requirements for joint–user airfields. So as to provide for military airfields becoming joint–user in the future, this principle should be followed also for the siting of new facilities on existing military airfields.

7. When Australian Defence Forces (ADF) conduct operations with EO loaded aircraft from airfields of foreign countries, the Australian Forces are to comply with the host nation’s instructions. The Officer-in-Charge (OIC) of the Australian Forces is also to comply with the EO instructions in this manual when conducting EO operations in foreign countries, whenever possible. When the OIC

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[1] The quantity distance applicable between EO loaded aircraft, aircraft shelters and EO storage facilities in direct support of EO operations will be referred to as Aircraft (Quantity) Distances (AD). The 'standard' Quantity Distances (QD) prescribed in Regulation 5.4 Annex A will be referred to as QD or QD criteria. Reference to quality or separation distance/criteria means a combination of both AD and QD, as appropriate for the particular situation.

cannot comply with the instructions in this manual, a risk assessment must be conducted in accordance with the instructions in Regulation 5.3 Procedure 2. If the OIC believes that ADF EO operations pose an unacceptable risk, in accordance with the EO instructions in this manual, to the facilities, equipment and personnel of the host nation or another foreign force, the OIC is to conduct a risk assessment and seek formal acceptance of the risk by the relevant authority of the host nation or the foreign force.

PRINCIPLES FOR THE APPLICATION OF SEPARATION CRITERIA

8. For the purpose of this instruction, ADF aircraft are to be treated as either weapons platforms or non-weapons platforms, according to their certified operational role. Weapons platform aircraft are those which are certified for the delivery of weapons to a target. For the determination of aircraft separation distances, a weapons platform aircraft may be considered as being an 'explosive ordnance loaded aircraft' even when it is not carrying a weapon load. A non-weapons platform aircraft is only to be considered as being an 'explosive ordnance loaded aircraft' if it has EO cargo. Higher constraints are placed on aircraft that are not employed as a weapons platform to ensure that they are not exposed to unnecessary risk from EO operations. However, Commanders are to exercise discretion to ensure that weapons platform aircraft are also not subjected to unnecessary risk when not directly involved in weapons programs.

Aircraft parking—designated areas

9. EO loaded aircraft must be parked, loaded, unloaded or armed in areas specifically designated for those purposes, eg Ordnance Loading Apron (OLA), and licensed in accordance with Regulation 5.2 Procedure 1. Where possible such designated areas should be separated from other such areas and from Exposed Sites (ES) by the separation criteria given in paragraphs 22- 48.

10. A loading, unloading or parking area specifically designated for continual use presents a recurring hazard and is to be formally authorised for the purpose. The maximum Net Explosives Quantity (NEQ) that any Explosive Ordnance Apron (EOA) or OLA may be licensed for is 10 000 kg.

11. **Exception.** The requirement of paragraphs 9 and 10 do not apply to aircraft containing only installed/stowed EO and safety devices such as authorised signal cartridges, fire-extinguisher cartridges, ejection seat cartridges and other such items necessary for flight operations – paragraph 12f refers.

Aircraft Parking—Principles for Selecting Designated Areas

12. The following principles should be followed in selecting designated areas:

a. The safest possible area, commensurate with the separation criteria prescribed in this instruction and operational requirements, must be selected.

b. The loading, unloading or parking area must be located outside runway clear zones[2]. Aircraft Safety Points (ASP) however, are exempted from this restriction.

c. The risk to routine military aircraft movements in the landing, take–off or taxiing phase, presented by EO loaded aircraft on ASP, EOA or OLA, is of a transient nature and consequently the hazard to these military aircraft need not be considered for separation purposes.

d. For traversed and untraversed aircraft, separation criteria are predicated on accepting the loss of one aircraft only (the aircraft on which the incident occurs) and no greater than Repair Category 3 damage (as defined in AAP 7001.059(AM1) Section 6, Chapter 2 Aircraft Damage Reports) or Moderate Damage (see Regulation 5.4 Annex A paragraph 177) to any adjacent aircraft. Where lesser alternative separation

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[2] In general, the applicable runway clearance is the 150 m lateral safety zone each side from the runway centre-line. For further details contact the appropriate section within the Corporate Services and Infrastructure Group.

distances are offered, the use of these distances increases the probability of direct propagation of the explosion and increases aircraft damage. The exception to this principle is the criteria of paragraph 39 where, if rescue and fire services are not responsive and effective and an EO loaded aircraft catches fire, the 10 m separation distance may contribute to the loss of adjacent aircraft.

e. **Forward Firing Ordnance.** Aircraft with forward firing ordnance represent a hazard to personnel, aircraft, equipment and facilities. The following is to be applied to minimise the risk associated with forward firing ordnance:

(1) **Engineering Design Review (EDR) and Explosives Risk Assessment (ERA).** If an approved EDR and ERA that has been developed, reviewed and approved by competent and authorised personnel in accordance with the relevant Weapon System Engineering Management Plan, demonstrates that the risks associated with the forward firing ordnance is acceptable, aircraft orientation and siting is not required. The EDR and ERA is to consider issues such as the aircraft weapons system safety design, ordnance safety design, competency and proficiency of personnel, adequacy and validity of procedures, and past experience with the aircraft weapon system. The outcomes of the EDR and ERA are be promulgated in standing instructions after review in accordance with the FEG's Risk Management Plan and acceptance by the FEG Commander or higher command, as appropriate.

(2) **Gun Forward Firing Direction.** In the absence of an approved EDR and ERA (paragraph 12e(1) refers), aircraft guns are to be pointed so that no inhabited building or centre of population exists within a 3 000 m, 10˚ conical region encompassing the line of fire ie 5˚ about the bore sight/line of fire, unless this region is effectively blocked by a suitable interceptor traverse. ASP are exempted from quantity-distance requirements however, the safety requirements for forward firing ordnance are to apply.

(3) **Missile Forward Firing Direction.** In the absence of an approved EDR and ERA (paragraph 12e(1) refers), the forward firing direction for aircraft guided and non-guided missiles is to comply with the requirements in paragraph 12e(2). However, due to the agility, velocity and random nature of a missile trajectory, the traditional safe forward firing direction may not mitigate the risk to personnel, aircraft, equipment and facilities. Accordingly, wherever practicable the firing direction should be effectively blocked by a suitable interceptor traverse.

f. Unless awaiting an EO load, the requirements for separation do not apply to aircraft containing installed/stowed EO of the types listed:

(1) Quantities of small arms ammunition for crew use.

(2) Pyrotechnic signalling devices.

(3) Egress system components.

(4) Squibs, fire extinguisher cartridges and ejector cartridges.

(5) Explosive components of emergency kits and equipment.

g. Fuel–loaded tanker aircraft are to be treated as non–EO loaded aircraft for separation purposes. However, tanker aircraft parked with their associated EO loaded aircraft must be considered as EO loaded aircraft for separation purposes.

ANNEX F

Facilities Directly and Indirectly Supporting Flight Line Operations for EO Loaded Aircraft

13. Facilities in 'direct support' of aircraft activities loaded with EO, ie EO operations at OLA and EOA, include squadron operations buildings, flightline crew and maintenance facilities, minor POL and liquid oxygen (LOX) facilities, fire and rescue stations and alert crew shelters. Facilities in 'indirect support' of EO operations, include all other facilities that support military airfield operations such as squadron non-flight-line maintenance facilities, airfield control tower, airfield fire stations, major POL and LOX facilities, and safety equipment storage facilities. Domestic support to the airfield, other Services' activities (other than joint operations) and personnel employed at the airfield in non- operational maintenance activities are not to be treated as being in 'indirect support' of EO operations.

Measurement of Quantity and Other Separation Distances

14. **Hazard Division (HD) 1.1 EO.** All separation distances from aircraft loaded with HD 1.1 EO are to be measured from the EO load (or from where that EO would normally be loaded) to the nearest point of the next aircraft or exposed site, unless otherwise stated. The effects of over–pressure and projections are the major concern.

15. **HD 1.2, 1.3 and 1.4 EO.** All separation distances from aircraft loaded with HD 1.2, 1.3 and 1.4 EO, either mixed together or separately, are to be measured from the nearest point of the EO loaded aircraft to the nearest point of the next aircraft or exposed site. The effects of projections, flame and radiated heat and burning debris are the major concern.

16. **Potential Explosion Sites (PES) to Runways and Taxiways.** All separation distances from a PES are to be measured from the nearest point of the PES to the nearest point of the taxiway and to the centre-line of the runway.

Siting of Explosive Ordnance Facilities

17. **Separation Distances to Operationally Essential Runways and Taxiways.** If the transient risk to military aircraft is accepted by the FEG Commander, any PES should, if possible, be separated from runways and taxiways which are considered to be operationally essential, by a minimum distance that would prevent the runways or taxiways being rendered non–operational by ground shock as a result of an explosion in the PES. Accordingly, the use of a distance equivalent to three times the crater radius is recommended. In normal soil AD4-distances ($1.8Q^{1/3}$) should be used; in saturated soils or clay, greater distances (between $2.0Q^{1/3}$ and $2.5Q^{1/3}$) may be advisable because of the increased crater radius. If the transient risk to aircraft is not accepted, AD13-distances ($12.0Q^{1/3}$) are to be used to provide protection to the aircraft. See Table 4F-2 for tabulation of AD-distances for airfields.

18. **Permanent Structures.** Permanent or long–term EO facilities with structures should not be sited within the approach or departure zones for either fixed or rotary wing aircraft. The siting of all permanent facilities adjacent to runways and taxiways must conform to mandated airfield layout requirements (see footnote 2).

19. **Explosive Ordnance Storage Areas.** The QD given in Regulation 5.4 Annex A apply to the siting of individual PES in EO storage areas. These QD also apply to the separation of runways and taxiways from PES in EO storage areas.

20. **Aircraft Safety Points.** The definition and purpose of an ASP is contained within the Glossary of Terms in the Preliminary Pages to this manual. While ASP locations are normally designated adjacent to the ends of the runways, they may also be located at OLAs. In all cases, ASP's must be located in order to provide the highest degree of safety to aircraft operations, aircraft infrastructure and personnel whilst meeting operational requirements. Except if required for emergency download of EO, ASP are exempt from separation requirements (if an emergency occurs such that the aircraft cannot be safely taxied or towed from the ASP, appropriate QD are to be applied while the aircraft remains on the ASP). Paragraph 12e requirements apply to all ASP. Approved ASP activities at an ASP located at an OLA are permitted provided that:

a. NEQ, HD, minimum separation distances and QD requirements can all be met for emergency downloads.

b. Paragraph 12e is applied to taxiing aircraft after an increase in state of readiness and before a decrease in state of readiness of an aircraft stores delivery system.

c. The Base Armament Manager (BAM), Explosives Custodian Officer (ECO) or equivalent confirms compliance with sub-paragraphs a and b.

21. OLA and EOA. OLA and EOA need not be treated as permanent EO facilities for the purpose of determining separation requirements. However, OLA and EOA should be sited outside the approach and departure zones if practicable and operationally acceptable. Consequently, a taxiing military aircraft can be considered as a transient risk with no requirement to apply clearances from the OLA or EOA to the aircraft.

SEPARATION DISTANCES FOR HD 1.1 EXPLOSIVE ORDNANCE LOADED AIRCRAFT

Separation Distances Between Hardened Aircraft Shelters and Associated Storage Facilities

22. Hardened Aircraft Shelters (HAS)[3] and associated storage facilities are to be spaced according to the separation distances tabulated at Table 4F-3. These separation distances will prevent propagation between such facilities. An explosion in one shelter or ready storage facility may destroy it and its contents, but aircraft within adjacent shelters will be undamaged provided the shelter doors are closed. Those aircraft may not be immediately removable due to debris.

23. HAS and associated storage facilities spaced according to the separation distances tabulated at Table 4F-4 may be damaged; however, there will be a high degree of protection against propagation. These distances should be used only in wartime, or during periods of increased operational readiness.

24. Areas of hazard to the front, side or rear of HAS or igloos as a PES or ES lie in the arcs shown in Figure 4F-1. A particular face of an ES is deemed to be threatened by a PES face when both these faces lie within the arc of threat or hazard of the other.

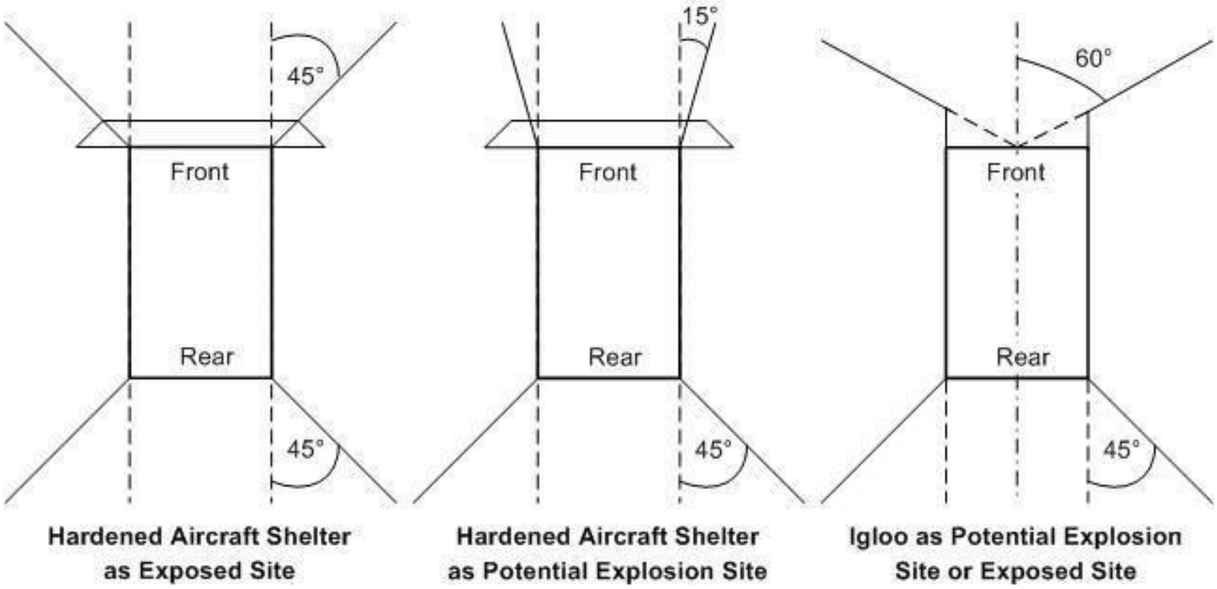

Figure 4F-1. Exposures - orientation to hardened aircraft shelter

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3 Information on HAS is included for the awareness of readers and to maintain commonality with NATO source documents. In the event that operations are undertaken in a HAS environment local expertise will be required to identify the construction type of HAS.

ANNEX F

Separation Distances between Hardened Aircraft Shelters (and Associated Storage Facilities) and Other Exposed Sites

25. Facilities that have been designed to protect personnel by providing resistance to blast, fragment damage, and the reduction of internal overpressure, may be considered 'hardened'. Such facilities, located for use by personnel in 'direct support' of EO loaded aircraft operations, may be sited at a minimum of AD6-distances ($2.4Q^{1/3}$) provided the door design of the facilities reduces the internal overpressures so as not to exceed 240mbar. If not so designed, personnel shelters are to be sited at a minimum of AD11-distances ($8.0Q^{1/3}$).

26. HAS and associated storage facilities are to be separated from the listed ES by the following minimum distances:

a. **Untraversed EO loaded aircraft** – AD13-distances ($12.0Q^{1/3}$). At this distance, the exposed aircraft may sustain damage from overpressure (120mbar), fragments and debris but should, in most cases, be readily repairable.

b. **Traversed (at the ES) EO loaded aircraft –** AD12-distances ($9.6Q^{1/3}$)(150 mbar overpressure). The traverse will prevent simultaneous propagation from high velocity, low angle fragments, however the traverse will not necessarily prevent subsequent propagation or damage caused by blast, lobbed items, debris or secondary fires.

c. **Traversed or untraversed non-explosives flight-lines (not at OLA)** - AD14-distances ($16.0Q^{1/3}$) (78 mbar overpressure).

d. **Ordnance preparation buildings in support of flight operations** - AD11-distances ($8.0Q^{1/3}$).

e. **Facilities in direct support of EO flight operations (unhardened)** - AD12-distances ($9.6Q^{1/3}$).

f. **Facilities in indirect support of EO flight operations** - AD14-distances ($16.0Q^{1/3}$).

g. General public and base administrative support facilities:

(1) Use AD16–distances ($14.0Q^{1/3}$) from the rear and AD17–distances ($18.0\ Q^{1/3}$) from the sides and front of ready service igloos containing up to 10 000 kg NEQ at loading density of up to 20 kg/m^3. Apply a minimum distance of 270 m to base administrative support facilities and low density Public Traffic Routes.

(2) When the PES is a United States third-generation or similar HAS containing up to 5 000 kg NEQ, the AD18–distances ($20.0Q^{1/3}$) from the front, the AD19–distances ($25.0Q^{1/3}$) from the side, and AD14–distances ($16.0Q^{1/3}$) from the rear may be used to protect an unhardened ES against debris and blast. With NEQ of 50 kg or less in a HAS, a minimum distance of 80 m to the front of the HAS and nil to the side and rear need only be applied.

(3) Use AD15–distances ($22.2Q^{1/3}$) for other PES where EO is present on a long term basis, and apply minimum distances of 270 m or 400 m depending on the nature of the PES (open vs igloo) and the ES (density of population).

(4) Where ES have been hardened, lesser distances may be used, depending on the degree of hardening provided.

Separation Distances between Traversed EO Loaded Aircraft and Exposed Sites

27. Traversed aircraft loaded with HD 1.1 EO are normally to be separated from each other by a minimum of AD 12-distances ($9.6Q^{1/3}$). At these distance personnel, aircraft and EO loads are reasonably protected. Personnel will suffer temporary hearing loss but other injuries from the direct effects of over–pressure are unlikely. There will be some injuries caused by fragments, debris, or translation of individuals involved. Aircraft are likely to suffer some damage to appendages and sheet metal skin; however, they should be operable with only minor repair (Moderate Damage in accordance with Regulation 5.4 Annex A paragraph 177).

28. When operational circumstances demand it or available land is insufficient, lesser separation than AD12- distances ($9.6Q^{1/3}$), as provided for below, may be used with deviation approval[4]:

a. AD10-distances ($7.2Q^{1/3}$) (250 mbar overpressure) – at these distance, aircraft and EO are reasonably protected from delayed propagation; however, the aircraft may suffer major damage requiring depot level maintenance. Personnel at the ES are likely to suffer eardrum damage, or be seriously injured, perhaps fatally, by debris, firebrands or other objects.

b. AD6-distances ($2.4Q^{1/3}$) (2 bar overpressure) – these distance will prevent simultaneous detonation of loaded EO but aircraft will be completely destroyed. Personnel at the ES will be killed by the effects of direct blast, by being struck by debris or fragments, or by impact against hard surfaces.

29. Traversed EO loaded aircraft are to be separated from the listed ES by the following minimum distances:

a. **Hardened Aircraft Shelters** - AD12-distances ($9.6Q^{1/3}$).

b. **Hardened Personnel Shelters** – AD6-distances ($2.4Q^{1/3}$) or AD11-distances ($8.0Q^{1/3}$) – see paragraph 25.

c. **Untraversed EO loaded aircraft** – AD12-distances ($9.6Q^{1/3}$) or,with deviation approval, AD10- distances ($7.2Q^{1/3}$) (see paragraphs 27 and 28 for applicable damage levels).

d. **Non–EO military aircraft** – AD13-distances ($12.0Q^{1/3}$) with a minimum distance of l80 m. Some personnel injuries are likely but these injuries are unlikely to be serious or fatal. Aircraft damage will be minor.

e. **Traversed (at the ES) open stack EO** - AD13-distances ($12.0Q^{1/3}$).

f. **EO workshops (including cargo loading and palletisation sites) in support of flight operations** – AD11-distances ($8.0Q^{1/3}$).

g. **Facilities in direct support of EO flight operations** – AD12-distances ($9.6Q^{1/3}$).

h. **Facilities in indirect support of EO flight operations (eg aircraft maintenance hangars but not base administrative support facilities)** – AD14-distances ($16.0Q^{1/3}$) with a minimum distance of l80 m.

30. Where the protection of personnel in the open is of major concern, the minimum fragment distances of Regulation 5.4 Annex A Table 4A-4 are to be considered.

31. The appropriate Outside Quantity Distances in Regulation 5.4 Annex A are to apply between EO loaded aircraft and ES not related to the servicing and support of those aircraft.

Separation Distances Between Untraversed EO Loaded Aircraft and Exposed Sites

32. Untraversed EO loaded aircraft are to be separated from each other by a minimum of AD13-distances ($12.0Q^{1/3}$). Aircraft loaded with HE bombs and missile warheads also should be aligned to gain the benefits described at paragraph 33. Lesser levels of blast and fragmentation damage will be

[4] The criteria in this paragraph apply only when traverses separating aircraft remain standing and intact long enough to trap all high speed, low angle fragments. Vertical traverses must, therefore, be constructed to withstand the expected over-pressure levels. If not so constructed, aircraft are to be considered as being untraversed.

sustained at separation distances of AD15- distances (5.5 $Q^{1/2}$/22.2$Q^{1/3}$) even if the criteria of paragraph 33 is not met. Where nearly complete protection against fragments is required a minimum distance of 270 m between aircraft is to be provided. Any reduction below 270 m progressively increases the risk of damage due to fragmentation, blast and radiant heat. Untraversed EO loaded aircraft separated by AD12-distances (9.6$Q^{1/3}$) distances and aligned as required by paragraph 33, may suffer some fragment damage but in most cases should remain operable.

33. Most GP bomb fragments (some 80%) and all those fragments having the highest velocity are found to occur in a zone approximately 300 either side of the axis at right angles to the bombs longitudinal axis (see Figure 4F-2). Provided EO loaded aircraft are aligned so that this equatorial zone is not pointing at other EO loaded aircraft, AD13- distances (12.0$Q^{1/3}$) provide a reasonable degree of protection to other untraversed EO loaded aircraft. This principle may be applied also to all aircraft fragmenting and continuous rod warheads fitted to guided weapons.

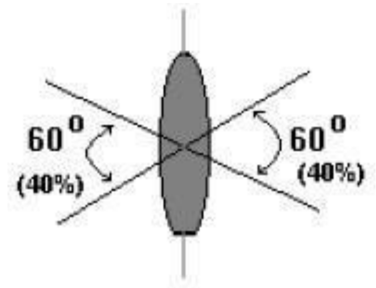

Figure 4F-2. Fragmentation Zone

34. Untraversed EO loaded aircraft are to be separated from the listed ES by the following minimum distances:

a. **Hardened Aircraft and ready-use shelters** - AD12-distances (9.6$Q^{1/3}$).

b. **Hardened Personnel Shelters** - AD6-distances (2.4$Q^{1/3}$) or AD11-distances (8.0$Q^{1/3}$) – see paragraph 25.

c. **Traversed EO loaded aircraft** – AD12-distances (9.6$Q^{1/3}$) or, with deviation approval, AD10-distances (7.2$Q^{1/3}$) (see paragraphs 27 and 28 for applicable damage levels).

d. **Non–EO military aircraft** – AD13-distances (12.0$Q^{1/3}$) with a minimum distance of l80 m. Some personnel injuries are likely but these injuries are unlikely to be serious or fatal. Aircraft damage will be minor.

e. **Traversed (at the ES) open stack EO** - AD13-distances (12.0$Q^{1/3}$).

f. **EO workshops (including cargo loading and palletisation sites) in support of flight operations** – AD14-distances (16.0$Q^{1/3}$).

g. **Facilities in direct support of EO flight operations** – AD12-distances (9.6$Q^{1/3}$).

h. **Facilities in indirect support of EO flight operations (eg aircraft maintenance hangars but not base administration buildings)** – AD14-distances (16.0$Q^{1/3}$) with a minimum distance of 180 m.

35. Where the protection of personnel in the open is of major concern, the minimum fragment distances of Regulation 5.4 Annex A Table 4A-4 are to be considered.

36. The appropriate Outside Quantity Distances in Regulation 5.4 Annex A should apply between EO loaded aircraft and ES not related to the servicing and support of those aircraft.

ANNEX F

SEPARATION DISTANCES FOR AIRCRAFT LOADED WITH HD 1.2, 1.3 AND/OR 1.4 EXPLOSIVE ORDNANCE

37. **HD 1.2 EO.** Aircraft loaded with or transporting HD 1.2 EO should be parked in traversed areas. Traversing will not prevent propagation caused by blast, radiated heat and flame, or by lobbed EO, but will prevent propagation by low angle, high velocity projections. Regardless of the type of accommodation, the following separation distances, with no NEQ limit, apply to aircraft loaded only with HD 1.2 EO:

a. **To other aircraft** – 25 m provided fire fighting is responsive and effective otherwise 90 m is required

b. **To occupied facilities constructed and used in accordance with paragraph 25.** - Determine separation distance by application of Regulation 5.4 Annex A Appendix 1 Table 1A1-2 D4 (Protected Process Building distance) for HD 1.2.1 and 1.2.2.

c. **To all other facilities** – 135 m provided road traffic in the vicinity can be stopped promptly and ES within 270 m radius can be evacuated. If either requirement cannot be met, a minimum of 270 m is to apply.

Exemptions to these requirements are given at paragraph 47.

NOTE

For fire fighting to be considered 'responsive and effective' the following state of fire response readiness is required as a minimum:

- First attack fire fighting equipment available at the site.
- A fire fighting vehicle response time of under 4 minutes.
- Fire section is to be notified prior to any loading or unloading activity.
- The loading team is to have direct communications with Air Traffic Control Tower or fire section for immediate fire fighting response.
- Fire fighting drills are carried out at six month intervals.

38. **HD 1.3 EO.** Aircraft loaded with or transporting HD 1.3 EO, are to be separated from other aircraft and facilities by the following distances:

a. **to other aircraft:**

less than 50 kg NEQ - 10 m

50 kg to 500 kg NEQ - 25 m

greater than 500 kg to 4 000 kg NEQ - 50 m

greater than 4 000 kg NEQ - 80 m

b. **to occupied facilities constructed and used in accordance with paragraph 25:**

less than 50 kg NEQ - 25 m

equal to or greater than 50 kg NEQ – Determine separation distance by application of Regulation 5.4 Annex A Appendix 1 Table 1A1-3 D2 (Protected Process Building distance) for HD 1.3.3 and 1.3.4

c. **to all other facilities:**

less than 50 kg NEQ - 25 m

50 kg to 1 000 kg NEQ - 60m

greater than 1 000 kg NEQ - 100 m

Exemptions are given at paragraph 47. Refer also to paragraph 40 for conditions applicable to countermeasures.

39. **HD 1.4 EO.** Separation distances for HD 1.4 are not a function of NEQ but are based on the fire risk to the ES. To this end aircraft transporting HD 1.4 EO are to be separated from other aircraft by a minimum distance of 10 m. If rescue and fire services are not responsive and effective then a minimum separation of 25 m is required. Separation criteria for aircraft loaded with HD 1.4 EO are given at paragraph 47.

40. **Projectable and Thrusted EO.** Aircraft with projectable or thrusted EO such as countermeasures represent a hazard to personnel, aircraft, equipment and facilities. Fire and/or projection impact are the main hazard resulting from accidental countermeasure flare ejection. The following is to be applied to minimise the risk associated with projectable and thrusted EO:

a. **Engineering Design Review and Explosives Risk Assessment.** If an approved EDR and ERA that has been developed, reviewed and approved by competent and authorised personnel in accordance with the relevant Weapon System Engineering Management Plan, demonstrates that the risks associated with the projectable or thrusted EO is acceptable, aircraft orientation and/or separation distances can be reduced. The EDR and ERA is to consider issues such as the aircraft weapons system safety design, ordnance safety design, competency and proficiency of personnel, adequacy and validity of procedures, effectiveness and responsiveness of fire fighting, use and effectiveness of deflectors and flare catchers, and past experience with the aircraft weapon system. The chance of promoting the fire at the incident aircraft may be increased when deflection barriers or flare catchers are used. The outcomes of the risk analysis including separation distances, are to be promulgated in standing instructions after review in accordance with the FEG's Risk Management Plan and acceptance by the FEG Commander or higher command, as appropriate.

b. **Aircraft Separation Distances.** In the absence of an approved EDR and ERA, aircraft are to be separated by the following distances to prevent the spread of fire to adjacent aircraft, equipment or facilities:

(1) Aircraft fitted with downward projected flares are to be separated in all directions by 25 m.

(2) Aircraft fitted with horizontal or vertical projected flares are to be separated by 100 m in the direction of the projection flare pattern provided the flare projection pattern is known.

(3) Aircraft fitted with vertical projected flares, or if the flare projection pattern is unknown, are to be separated in all directions by 100 m.

(4) Aircraft fitted with thrusted flares are to be separated by the OEM determined separation distances in all directions since the thrusted flare path is indeterminate. If the OEM distance is unknown, a minimum of 2,000m is to apply. Any reduction of separation distance below 2000m is to be approved in accordance with paragraph 40a.

ANNEX F

REQUIRED SEPARATION DISTANCES WHEN EXPLOSIVE ORDNANCE OF MORE THAN ONE HAZARD DIVISION IS LOADED

41. When aircraft, other than transport aircraft, are loaded with HD 1.1 and any other hazard division EO, the separation distances required are those for the HD 1.1 EO only. Where hazard divisions, other than HD 1.1 are loaded, the required separation is that given by either the HD 1.2 EO only, or the HD 1.3 EO only, or the HD 1.4 EO only, whichever distance is the greater. For calculation purposes, the HD are not to be aggregated.

42. For transport aircraft carrying mixed hazard divisions, determine the separation distances for the aggregate quantity, ie the total quantity of HD 1.1, 1.2 and l.3, considered as HD l.1, next as HD l.2 and finally as HD 1.3. The required separation distance is the greatest of these three distances.

AIRCRAFT CONFIGURED ONLY WITH GUNS AND/OR MISSILES (NOT IN HARDENED SHELTERS)

43. Unless there is a high probability of instantaneous propagation occurring within a gun system magazine, aircraft loaded only with gun ammunition not exceeding 30 mm (HE or Practice) are exempt from separation requirements to other similarly loaded aircraft, ie separated as required for normal aircraft manoeuvring; however, the provisions of paragraphs 12d and 12e are to be applied and ammunition for side–mounted helicopter guns is not to be loaded to guns until the aircraft enters the range or approved firing area.

44. The NEQ of missiles need not be aggregated (gun ammunition NEQ is disregarded) and the NEQ of the largest warhead only is to be used for separation calculations provided the warheads of adjacent missiles are sufficiently separated to prevent propagation. Table 4F-1 defines the separation distances for current in-Service missiles.

	AIM-9	AIM-120	AIM-132
AIM-9	560 mm	(1)	(1)
AIM-120	(1)	(1)	(1)
AIM-132	(1)	(1)	(1)
Note: 1. The separation to prevent propagation is not known therefore the NEQ of these missiles is to be aggregated.			

Table 4F–1: Missile Separation Distances to Prevent Propagation

45. Where the missile separation distances of paragraph 44 cannot be met and provided the warheads of the missiles are not radially aligned, ie the warheads are forward of or to the rear of each other without overlap, the NEQ of one missile warhead applies. If more than two missiles are loaded to any one side of an aircraft, the total NEQ of the EO loaded to that side is used to calculate aircraft separation distances.

46. The provisions of paragraphs 44 and 45 provide for the fact that the missile separation distances prescribed prevent simultaneous detonation. The provisions will not, of course, prevent delayed propagation and fire and rescue personnel must be made aware of this hazard.

EXPLOSIVE ORDNANCE LOADED AIRCRAFT EXEMPT FROM NORMAL SEPARATION DISTANCE REQUIREMENTS

47. Aircraft loaded only with the following EO, or EO that can be demonstrated as having similar propagation characteristics, are exempt from the normal separation requirements to other aircraft:

a. Gun ammunition (30 mm or less) loaded together with other items listed in this paragraph (see paragraph 43 for gun ammunition only).

b. 2.75 in rockets (excluding HD 1.1 warheads and WP).

c. HD 1.4 EO.

d. Pyrotechnics (excluding counter–measure flares – see paragraph 40).

e. Practice bomb, BDU–33 C/B and 5 kg.

f. Mk 64 Mod 0 Signals Underwater Sound/Marine Sound Signals (distance of 40 m is required to other facilities).

g. Smoke Grenades.

Aircraft exempt from separation criteria must still be loaded and parked in a designated area, ie OLA, treated as EO loaded aircraft in all other respects, and separated as required for normal aircraft manoeuvring. A minimum distance of 25 m to other facilities applies. The exemption allowed by this paragraph is not permitted for EO loaded as cargo.

48. The provisions of paragraph 12e apply to aircraft loaded with forward firing ordnance.

SEPARATION DISTANCE CRITERIA FOR JOINT–USER AIRFIELDS

49. **General.** Operations at joint–user airfields are to be conducted to provide the highest level of safety to the public. For example, taxi routes for EO loaded aircraft should be separated as far as possible from civilian terminal buildings and aircraft loaded with EO should be separated as far as possible from civilian aircraft.

50. The following requirements, additional to those applying to military-use-only airfields, are to be applied at joint-user airfields:

a. **General.** Aircraft are generally more vulnerable to the effects of blast overpressure during take-off and landing than when taxiing or overflying a runway. Large aircraft have larger control surfaces than light aircraft and take-off and land at greater speeds, and therefore may receive higher stress loads from blast overpressure. As it is not feasible to accurately predict how every type of aircraft will behave, the application of separation distances for civil aircraft operations should be based on personnel exposure rather than aircraft preservation. Hence, runways and taxiways are to be treated as major (Group IV) or minor (Group III) public traffic routes according to the traffic density and the types of aircraft utilising the airfield. Guidance to this end is given in Appendix 1.

b. **Deviation Requirements.** In circumstances where the siting of OLA and EOA on joint-user airfields cannot comply with the separation requirements prescribed in this instruction a deviation must be sought and be accompanied by an ERA. Guidance on the conduct of ERA is given in Regulation 1.2.

c. **Zone Planning.** For zone planning at joint-user airfields, all runways and taxiways are to be considered as major traffic routes unless it is evident that the aircraft traffic density will never warrant them being treated higher than minor public traffic routes.

RADIO FREQUENCY HAZARDS

51. The procedures required to avoid inadvertent initiation of electro–explosive devices during handling and loading of EO onto aircraft, as specified in Regulation 4.4 Procedure 15, are to be implemented during all airfield EO operations.

MARKING OF AIRFIELD EXPLOSIVE ORDNANCE FACILITIES

52. Airfield EO facilities such as OLA, EOA and ASP are not usually annotated on airfield layout maps nor are they assigned facility numbers thus making it difficult for user units to know with certainty the position of these facilities on the airfield. Furthermore, for EO licensing purposes and associated QD measurements, the extremities of the facilities need to be designated and safe directions for guns and missiles need to be marked. Accordingly, airfield EO facilities are to be marked using the guidance in Appendix 2.

53. Base Armament Managers are responsible for ensuring that all airfield EO facilities are marked and that location maps are raised and issued to all user units and other airfield personnel, eg emergency response personnel, air traffic controllers, etc for whom this information is essential for the effective conduct of their functions.

Appendices:

1. Determination of Traffic Route Classification for Runways and Taxiways on Joint-User Airfields
2. Marking of Airfield Explosive Ordnance Facilities

ANNEX F

Net Explosives Quantity (NEQ) in kg	Quantity distances in metres																		
	AD1	**AD2**	**AD3**	**AD4**	**AD5**	**AD6**	**AD7**	**AD8**	**AD9**	**AD10**	**AD11**	**AD12**	**AD13**	**AD14**	**AD15**	**AD16**[a]	**AD17**[a]	**AD18**[a]	**AD19**[a]
500	4	6	9	15	16	20	25	29	35	58	64	77	95	130	270	270	270	160	200
600	5	7	10	16	17	21	27	31	38	61	68	81	100	135	270	270	270	170	215
700	5	7	10	16	18	22	28	32	40	64	72	86	105	145	270	270	270	180	225
800	5	7	11	17	19	23	30	34	41	67	75	90	110	150	270	270	270	190	235
900	5	8	11	18	19	24	31	35	43	70	78	93	115	155	270	270	270	195	245
1000	5	8	11	18	20	24	32	36	44	72	80	96	120	160	270	270	270	200	250
1200	6	9	12	20	21	26	34	39	47	77	86	105	130	175	270	270	270	215	270
1400	6	9	13	21	22	27	36	41	50	81	90	110	135	180	270	270	270	225	280
1600	6	9	13	22	23	29	37	43	52	85	94	115	140	190	270	270	270	235	295
1800	7	10	14	22	24	30	39	44	54	88	99	120	145	195	270	270	270	245	305
2000	7	10	14	23	25	31	40	46	56	91	105	125	150	205	270	270	270	255	315
2200	7	10	14	24	26	31	42	47	57	94	105	125	155	210	270	270	270	265	330
2500	7	11	15	25	27	33	43	49	60	98	110	135	165	220	275	270	270	275	340
3000	8	12	16	26	29	35	46	52	64	105	120	140	175	235	305	270	270	290	365
3500	8	12	17	28	30	37	49	55	67	110	125	150	180	245	330	270	275	305	380
4000	8	13	18	29	32	39	51	58	70	115	130	155	190	255	350	270	290	320	400
4400	8	13	18	30	33	39	52	59	72	120	135	160	200	260	365	270	295	330	410
5000	9	14	19	31	34	42	55	62	76	125	140	165	205	275	380	270	310	345	430
6000	10	15	20	33	36	44	58	66	80	135	150	175	220	295	405	270	330		
7000	10	15	22	35	38	46	61	69	85	140	155	185	230	310	425	270	345		
8000	10	16	22	36	40	48	64	72	88	145	160	195	240	320	445	280	360		
8800	10	17	23	37	41	50	66	74	91	150	170	200	250	330	460	290	375		
9000	11	17	23	38	42	50	67	75	92	150	170	200	250	335	465	295	380		
10000	11	17	24	39	43	52	69	78	95	160	175	210	260	345	480	305	390		
Distance Functions	$0.5Q^{1/3}$	$0.8Q^{1/3}$	$1.1Q^{1/3}$	$1.8Q^{1/3}$	$2.0Q^{1/3}$	$2.4Q^{1/3}$	$3.2Q^{1/3}$	$3.6Q^{1/3}$	$4.4Q^{1/3}$	$7.2Q^{1/3}$	$8.0Q^{1/3}$	$9.6Q^{1/3}$	$12.0Q^{1/3}$	$16.0Q^{1/3}$	(b)	$14.0Q^{1/3}$	$18.0Q^{1/3}$	$20.0Q^{1/3}$	$25.0Q^{1/3}$

Note

(a) See paragraphs 26-29:

(b) AD15 = $15.5Q^{1/2}$ for Q<4500 kg; and $22.2Q^{1/3}$ for Q ≥4500kg.

Table 4F-2: Quantity Distance table for airfields (Hazard Division 1.1)

FROM (PES) / TO (ES)		1st Generation Aircraft Shelter[a]			2nd or 3rd Generation Aircraft Shelter[a]			Ready Service Igloo[b]				Ready Service Magazine[c]		Igloo				Magazine	
		Side	Rear	Front	Side	Rear	Front	Side	Rear	Front Trav	Front Untrav	Trav	Untrav	Side	Rear	Front Trav	Front Untrav	Trav	Untrav
1st Generation Aircraft Shelter	Side	AD8	AD6	AD8	AD8	AD6	AD8	AD3	AD3	AD7	AD7	AD7	AD7	AD5	AD5	AD7	AD7	AD7	AD7
	Rear	AD7	AD5	AD7	AD7	AD5	AD7	AD3	AD3	AD7	AD7	AD7	AD7	AD5	AD5	AD7	AD7	AD7	AD7
	Front	AD10	AD10	AD10	AD10	AD10	AD10	AD9	AD8	AD10	AD10	AD10	AD10	AD10	AD10	AD10	AD10	AD10	AD10
2nd or 3rd Generation Aircraft Shelter	Side	AD8	AD6	AD8	AD8	AD6	AD8	AD3	AD3	AD7	AD7	AD7	AD7	AD5	AD5	AD7	AD7	AD7	AD7
	Rear	AD7	AD5	AD7	AD7	AD5	AD7	AD3	AD3	AD7	AD7	AD7	AD7	AD5	AD5	AD7	AD7	AD7	AD7
	Front	AD9	AD8	AD10	AD9	AD8	AD10	AD3	AD3	AD7	AD7	AD7	AD7	AD5	AD5	AD7	AD7	AD7	AD7

For distance functions: *see* table 4F-2.

Note

(a) Limited to a maximum of 5000 kg per shelter.

(b) Ready service Igloo—an earth-covered EO storage location, often utilising an arch-type interior shell, used to store built-up EO for combat aircraft loading. Storage is limited to not more than 10 000 kg NEQ and a loading density of not more than 20 kg $m^{-1/3}$.

(c) Ready service magazine—any above-ground EO storage facility, other than an igloo, used to store built-up EO for combat aircraft loading. Storage is limited to not more than 10 000 kg NEQ.

Table 4F-3: Asset Preservation

FROM (PES)		1st Generation Aircraft Shelter			2nd or 3rd Generation Aircraft Shelter[a]			Ready Service Igloo[c]				Ready Service Magazine[d]	
TO (ES)		Side	Rear	Front	Side	Rear	Front	Side	Rear	Front Trav	Front Untrav	Trav	Untrav
1st Generation Aircraft Shelter	Side	AD2	AD2	AD3	AD2	AD2	AD3	AD1[e]	AD1[e]	AD3[f]	AD3[f]	AD3	AD3
	Rear	AD2	AD2	AD3	AD2	AD2	AD3	AD1[e]	AD1[e]	AD3[f]	AD3[f]	AD3	AD3
	Front	AD6	AD4	AD7	AD6	AD4	AD8	AD3[f]	AD3[f]	AD6[f]	AD8[f]	AD6	AD8
2nd or 3rd Generation Aircraft Shelter	Side	AD2	AD2	AD3	AD2	AD2	AD3	AD1[e]	AD1[e]	AD3[f]	AD3[f]	AD3	AD3
	Rear	AD2	AD2	AD3	AD2	AD2	AD3	AD1[e]	AD1[e]	AD3[f]	AD3[f]	AD3	AD3
	Front	AD4	AD3	AD5	AD4	AD4	AD6	AD1[e]	AD1[e]	AD3[f]	AD3[f]	AD3	AD3
Ready Service Igloo	Side	AD2	AD2	AD3	AD2	AD2	AD3	Use Regulation 5.4 Annex A Appendix 1.					
	Rear	AD2	AD2	AD3	AD2	AD2	AD3						
	Front Trav	AD3	AD3	AD5	AD3	AD3	AD6						
	Front Untrav	AD6	AD4	AD7	AD6	AD4	AD8						
Ready Service Magazine	Trav	AD6[b]	AD6[b]	AD6	AD6[b]	AD6[b]	AD6						
	Untrav	AD9	AD9	AD9	AD9	AD9	AD9						

For distance functions: *see* table 4F-2.

Note

(a) Limited to a maximum of 5000 kg per shelter.

(b) This separation provides a high degree of protection. AD3–distances may be used for robust stores or in wartime or emergency situations and would provide a moderate degree of protection.

(c) Ready service Igloo—an earth-covered EO storage location, often utilising an arch-type interior shell, and often used to store built-up EO for combat aircraft loading. Storage is limited to not more than 10 000 kg NEQ and a loading density of not more than 20 kg$^{-1/3}$, except as noted below.

(d) Ready service magazine—any above-ground storage facility, other than an igloo, used to store built-up EO for combat aircraft loading. Storage is limited to not more than 10 000 kg NEQ.

(e) Use AD2–distances where the loading density exceeds 20 kg m$^{-1/3}$.

(f) The loading density limitation of 20 kg m$^{-1/3}$ not to be applied.

Table 4F-4: Propagation prevention

APPENDIX 1 TO ANNEX F

DETERMINATION OF TRAFFIC ROUTE CLASSIFICATION FOR RUNWAYS AND TAXIWAYS ON JOINT-USER AIRFIELDS

Determination of Population Density on Runways and Taxiways

1. In order to simplify the determination of population density on runways and taxiways, aircraft are to be categorised as follows:

a. **Category l** - any civil operated light aircraft or helicopters that do not carry more than 12 persons.

b. **Category 2** - any civil operated aircraft or helicopters that carry more than 12 persons but not more than 100.

c. **Category 3** - any civil operated aircraft that carries more than 100 persons.

Application of Public Traffic Route Distances to Runways and Taxiways

2. **Public Traffic Route Classification Criteria.** The criteria for determining the applicable public traffic route classification (major or minor) to runways and taxiways are as follows:

a. **Major Traffic Routes:** Major traffic route distances are to apply if aircraft movements exceed the following criteria:

(1) **Category 1** - 150 per day or 15 per hour,

(2) **Category 2** - 15 per day or five per hour, and

(3) **Category 3** - five per day or two per hour.

b. **Minor Traffic Routes:** Minor traffic route distances are to apply if aircraft movements do not exceed the criteria for Major Traffic Routes at sub-paragraph a.

3. **Public Traffic Route Classification Conditions.** In determining the classification of traffic routes at paragraph 2 the following conditions apply:

a. An aircraft practicing touch-and-go movements is to be categorised by the number of persons on board at the time. Touch-and-go movements are to be treated as a single movement if, in the process, the aircraft does not come to rest or change direction on the ground. For all other movements each landing and take-off for a single aircraft constitutes two movements.

b. The number of movements aligned to each of the stated categories should not be considered in isolation of one another and responsible Licensing Authority is to estimate the number of personnel being put at risk when determining the application of minor or major traffic route distances. As a guide to examining the various combinations that could prevail, major traffic route distances should be applied when the number of movements exceeds 50 per cent of their minimum limits in any two of the stated categories, or one-third in all three categories. Similar adjustments should be made for differing combinations, using typical personnel levels of 1500 per day or 100 per hour as the main consideration.

4. **Public Traffic Route Distances.** The applicable Public Traffic Route Distances are given in the Quantity Distance Tables at Regulation 5.4 Annex A.

**APPENDIX 2 TO
ANNEX F**

MARKING OF AIRFIELD EXPLOSIVE ORDNANCE FACILITIES

Introduction

1. Airfield Explosive Ordnance (EO) facilities often are not precisely located on airfield EO facility maps nor are they allocated facility numbers. Consequently, to ensure that quantity-distance, orientation and safe direction requirements are met, it is necessary that those EO facilities are precisely located both physically and on airfield EO facility maps.

Applicable Airfield EO Facilities

2. The following Airfield EO facilities are to be marked:

a. Ordnance Loading Aprons (OLA),

b. Aircraft Safety Points (ASP), and

c. Explosive Ordnance Aprons (EOA).

Marking of Airfield EO Facilities

3. Airfield EO facilities are to be located in accordance with the applicable Form EO 003 Explosives Handling Area Explosives Limit Licence. The extremities of each facility are to be defined by painting a white square (minimum 200 mm sides) at each corner of the licensed area. Using minimum 30 mm black lettering, each square is then to be stencilled with the facility number as shown on the Form EO 003 and with details of the corner depicted by the square, e.g.: OLA2 NE, EOA1 W.

4. At OLA and ASP, the loading/downloading of forward firing ordnance may require aircraft to be parked in a safe direction and the loading/downloading of HE weapons may require the aircraft to be oriented to take into account of weapon fragment envelopes. These conditions require that a white arrow(s) is marked on the tarmac/hardstand to indicate the safe direction/orientation of the aircraft at each of the aircraft parking points. The arrow is to be positioned at the nose wheel parking position for each aircraft. Dimensions of the arrow and details to be marked on the arrow are shown at Figure 4F2-1.

5. Units should liaise with Base Facilities Section prior to marking any Runway, Taxiway or hardstand areas.

Expired Licences

6. When a licence is cancelled or expires, and is not to be renewed, the markings applicable to that licence are to be obliterated.

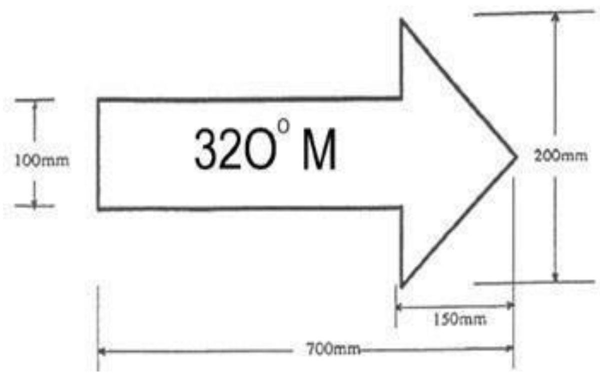

Figure 4F2–1: Example of Aircraft Safe Direction/Orientation Arrow

ANNEX G

QUANTITY DISTANCES FOR TRANSFER OF EXPLOSIVE ORDNANCE IN NAVAL PORTS

This policy was previously contained in OPSMAN 3, Part 5, Chapter 4. In subsequent amendments to this publication this reference will be removed.

Introduction

1. Due to the design of vessels afloat, and their behaviour in the event of an explosion, it is necessary to apply different quantity distances from one vessel to another, i.e. Ship (Quantity) Distances (SD), than the quantity distances that would be applied between aboveground explosive ordnance (EO) facilities and other sites. The principles and quantity distance criteria[1] to be observed in ports and waterways for the berthing, anchoring, or mooring of vessels carrying EO are detailed in this instruction. In the application of these principles each vessel is to be considered as either a Potential Explosion Site (PES) or an Exposed Site (ES) if it is at risk from a PES.

General

2. These principles are designed to give maximum practicable protection to other vessels, port facilities, personnel working in the port, and the general public. They should be applied when licensing berths, buoys or anchorages at which EO may be handled, or at which certain types of vessels carrying EO may be berthed or anchored.

3. It must be emphasised that probability of propagation and the severity of damage and casualties are all directly related to separation distance. Accordingly, any increase to quantity distance criteria recommended in this instruction will result in improved levels of protection. In addition, good working practices can do much to reduce the probability of propagation; for example, mooring ships in tandem and closing hatches. The Licensing Authority (LA) may need to keep such factors in mind in reaching its decisions. It must be emphasised that probability of propagation, damage and casualties are all directly related to separation distance. Any increase in separation above the QD recommended in this chapter will result in improved levels of protection. In addition, good working practices can do much to reduce the probability of propagation; for example, mooring ships in tandem and closing hatches. The licensing authorities may need to bear such factors in mind in reaching their decisions.

Purpose

4. This annex sets out a desired level of protection, principles and quantity distance (QD) criteria for the transfer of explosive ordnance (EO) to be observed in ports and waterways when vessels carrying EO are berthed, anchored, or moored.

Applicability

5. These safety principles apply to the separation distances to be observed by vessels loaded with military explosives. Examples of such vessels include:

a. warships and support vessels during loading, unloading or handling operations of EO stored in the ships' magazines, which is intended for the service of shipboard armament or aircraft;

b. warships carrying EO as cargo;

c. cargo ships and transports;

---

[1] The quantity distances applicable from one vessel to another will be referred to as Ship (Quantity) Distances (SD), and quantity distances from vessels to port facilities such as inhabited buildings and the like, will be referred to as QD, i.e. standard quantity distances prescribed in Regulation 5.4 Annex A. Reference to quantity distance means a combination of both SD and QD, as appropriate for the particular situation.

d. lighters, barges and small coastal craft (i.e. watercraft with shallow draught); and

e. support and auxiliary oiler replenishment (AOR) vessels. These vessels fitted for transfer at sea carrying both EO and bulk cargoes of POL may present a greater risk to the EO cargo than other types of ships due to the fire hazard. The blast and fragment effects from the EO in such a ship are unlikely to be augmented by the presence of POL, but the subsequent fire hazard could be increased. In the case of vessels carrying bulk quantities of EO as cargo, e.g. AOR, the total Net Explosives Quantity (NEQ) of all EO of Hazard Divisions 1.1, 1.2 and 1.3 held on board must be aggregated and the appropriate QD provided regardless of whether or not the EO is being worked.

f. foreign warships, support vessels and auxiliaries under military control in the same manner as for RAN ships.

Vessels Excluded From These Principles

6. Any Royal Australian Navy (RAN) ship carrying EO is to be regarded as a Potential Explosion Site (PES), however the Principles detailed in this Chapter are not applicable to RAN ships or support vessels which carry EO in certified ship's magazines in accordance with a valid EO Storage and Handling (S&H) EOS&H Certificate and the requirements detailed in ABR862 Vol 2 Chap 3 and Ch 4 have been met, provided that these magazines are not worked upon when the vessel is at the berth The principles however, do apply to these vessels when exposed to other PES.

7. They do not apply to EO required for ship's security in harbour or sea safety including:

a. pyrotechnic stores required to be immediately available for signalling or navigation purposes by ships when entering or leaving harbour, in accordance with the Navigation Act, may be handled; and

b. At the discretion of the Commanding Officer, small quantities of small arms ammunition and smoke producing pyrotechnics may be handled if required for maintaining security aboard ship and for training purpose.

NOTE

They do, however, apply to the loading, off-loading, or handling of such EO.

Calculation of Net Explosives Quantity

8. It is possible that an explosion could involve all the EO carried on-board a ship because of the close proximity of the ships' compartments, holds, adjacent transfer areas, and possibly EO on deck. Whatever the distribution of EO in a ship, it is likely that an initial explosion of any significant size will cause the complete loss of the vessel. Propagation may or may not be simultaneous, depending on the design of the ship and the distribution of the EO and other cargo aboard.

9. For this reason the NEQ of all of Hazard Divisions 1.1, 1.2 and 1.3 is therefore, normally, to be aggregated in accordance with the rules contained in Regulation 5.4, so that the ship is considered as a single PES. However, it is sometimes possible to arrange for a ship's explosives cargo to be stowed in such a way that the simultaneous propagation of an explosion from one stowage location to another would not occur. Such stowage must include both a separation distance and traversing to intercept and prevent high-speed fragments initiating a simultaneous explosion. Under these circumstances the aggregation rules may be modified at the discretion of the LA.

10. The calculation of the required separation criteria may therefore be based on the hold[2] with the largest NEQ provided that:

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[2] The term 'hold' refers to any cargo space used for the stowage of EO and includes EO magazines, EO lockers and Vertical Launch System spaces.

a. holds are separated by at least 0.8Q1/3m (see table 4G-1)

b. intervening holds are densely loaded with inert material such as, tinned foods, water ballast, ship’s machinery, keg beer, 1.4 ammunition, etc, to form a traverse at least equivalent to traversing normally provided for storage ashore i.e. 2.4m of earth at the height of the EO stack. Care must be taken to ensure that there are no ‘windows’ in the traverse, particularly where stowage on different deck levels is envisaged. In case of doubt as to the equivalent effectiveness of the traverse, advice is to be sought from appropriately qualified EO specialist staff;

c. there is no EO on the decks;

d. during loading and unloading operations, only one hold[3] may be worked at any one time; and

e. during loading and unloading operations care must be taken to ensure that inert material remains in place to provide a traverse

11. When assessing the NEQ of a ship for licensing purposes the following must be taken into account:

a. all EO adjacent to the ship on the jetty or in vehicles and all EO in vessels and craft alongside the ship;

b. all EO being handled, stored and/or fitted in launchers on the deck of the ship.

Traversed/Untraversed Explosive Ordnance

12. EO in a vessel is considered to be traversed when it is stored at least 0.5m below the waterline. Conversely, if EO is stored less than 0.5 m below the waterline, the total quantity of EO embarked is to be considered as untraversed.

Quantity Distances

13. QD to be observed by the vessels defined in paragraph 5 when carrying, loading or unloading EO at piers, jetties, wharves or anchorages are given in table 4G–1 and are to be applied as detailed in paragraphs 14 – 19 for the NEQ concerned to ensure adequate protection of the ES.

14. Measurements are made from the nearest point of compartments in which EO is stowed in a berthed or anchored vessel to the nearest point of the ES.

15. When QD are calculated from table 4G–1, due allowance is to be made for movement of ships due to tides when anchored or berthed at a single buoy. The radius of the swinging circle is to be taken into account in the overall distance and the position of the aftermost compartment in which EO is stored taken as the point from which the QD should be measured.

16. If it is necessary to berth two or more vessels containing EO at less than the appropriate separation distance that is required by considering each ship as a separate PES (i.e. SD2, SD3 or SD4–distances as appropriate), the total NEQ of the cargo of both vessels is to be used to determine QD to any other ES.

17. If berthing of two vessels together is necessary, they should preferably be moored in tandem (i.e. one behind the other) as the bows and sterns will afford additional protection to each of the vessels by reducing their exposed areas. Provided that the conditions detailed in paragraph 13 have been met this should allow the vessels to be treated as effectively traversed. Vessels so berthed should be secured by the bows and sterns to prevent swinging.

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[3] In this context the term 'hold' refers to any cargo space used for the stowage of EO and includes EO magazines, EO lockers and Vertical Launch System spaces, if an accidental explosion, in any of these spaces, is likely to propagate the explosion to any other cargo space.

ANNEX G

18. Table 4G–2 is a summary of QD to be observed for vessels loaded with or loading or unloading EO of HD 1.1 in naval ports.

19. The application of greater minimum separation distances may be appropriate where nuclear powered vessels are considered as ESs. The advice of the LA is to be sought if this situation arises.

Levels of Protection

20. For Hazard Division 1.1, three levels of protection are provided (see paragraph 22). Each level contains three elements as follows, the application of which is dependent on the particular ES under consideration:

a. Likelihood of propagation of an explosion between PES and ES. Applies to those ES which contain EO.

b. Probable damage to ES. Applies to all ES.

c. Probable casualties resulting at ES. Applies to all ES.

21. There is only one level of protection against propagation, namely protection level B, allowed for, in accordance with the principles laid down in this manual. It is considered that protection level A is inappropriate since no vessel is capable of providing complete protection against protection equivalent to that afforded by an earth covered structure. In addition since, under protection level C, the loss of stocks, and therefore all likelihood the vessels containing them, at the ES is almost guaranteed in the event of an accidental explosions at the PES this level of protection is not considered as a normally acceptable option.

Levels of Protection for Hazard Division 1.1

22. **Protection Level A.** The following effects are expected at protection level A:

a. **Propagation.** A high degree of protection against immediate propagation of explosions or fire being provided.

b. **Damage.** Damage to vessels being limited to superstructures and non-vital structural members.

c. **Casualties.** Some injuries, which may be fatal, to exposed personnel at the ES, are likely due to fragments, debris and firebrands.

23. **Protection Level B.** The following effects are expected at Protection Level B:

a. **Propagation.** A limited degree of protection against immediate propagation of an explosion being provided. EO in adjacent vessels may however, detonate subsequently as a result of fires, but coalescence of shock waves from such explosions is unlikely and quantities need not be totalled for separation distance purposes. There is a high degree or protection against practically instantaneous propagation of explosion by ground shock, blast, flame and high velocity projections. There are occasional fires or subsequent explosions caused by these effects or by lobbed EO. Heavy cased EO is likely to be serviceable although covered by debris. However, the probability is significant that the stocks of other types of EO are likely to be lost through subsequent propagation from lobbed EO or the spread of burning debris.

b. **Damage.** Damage to adjacent vessels will include buckling of the hull and superstructure.

c. **Casualties.** Exposed personnel at ES are likely to suffer serious injury or death from fragments, debris and firebrands.

24. **Protection Level C.** The following effects are expected at Protection Level C:

a. **Propagation.** A limited degree of protection against immediate propagation of an explosion being provided for traversed vessels. However, subsequent propagation to adjacent vessels is likely through firebrands, missiles or lobbed EO, but coalescence of shock waves is unlikely and quantities need not to be totalled for separation distance purposes.

b. **Damage.** The buckling of hull and superstructure and damage in adjacent vessels will be serious due to fragment penetration and blast.

c. **Casualties.** Exposed personnel at ES will suffer serious injury or death from blast, fragments and firebrands.

Protection between Vessels each Loaded with Explosive Ordnance

25. General. Vessels loaded with EO must be separated from other vessels loaded with EO by QD selected according to the HD of the EO concerned and the type of vessel at the ES. If the vessel is a warship this may be discounted from consideration provided the conditions of paragraphs 8 - 11 have been met.

26. HD 1.1. For HD 1.1, Protection Level B should be applied wherever practicable. Different separation distances are recommended for warships and other explosive carrying vessels because of the rationale given at paragraph 13. Smaller separation distances are also quoted which may be applicable when it is unlikely that significant numbers of personnel will be exposed to blast and debris hazards. Berthing of vessels in tandem will help decrease the fragment hazard to the explosive cargo because of the additional protection afforded by the bow and stern. The QD which should be used are given in table 4G–1.

27. Normal protection level (B) for vessel carrying EO:

a. Untraversed: SD3.

b. Traversed: SD2

NOTE

The QD associated with the other protection levels are:

Protection Level A:

For untraversed vessels: SD3–distances given in table 4G–1.

Traversed vessels: SD3–distances provide a markedly higher degree of protection than level A.

Protection Level C:

For traversed vessels only: SD1—distances give in table 4G–1.

28. HD 1.2. For HD 1.2, fixed separation distances are applied as follows. Protection Level A should be applied wherever practicable. Protection Level B may be acceptable when it is unlikely that significant numbers of personnel will be exposed to fragments, debris and/or lobbed EO hazards. The protection levels are:

a. **Protection Level A.** For Protection Level A, vessels loaded with EO are to be separated by a minimum distance of:

(1) 90 m for EO of HD 1.2.2, or

(2) 135 m for EO of HD 1.2.1. These distances will apply to traversed or untraversed vessels for any quantity of EO.

b. **Protection Level B.** For Protection Level B, vessels loaded with EO are to be separated by a minimum distance of:

(1) 60 m for EO of HD 1.2.2; and

(2) 90 m for EO of HD 1.2.1.

NOTE

An incident involving EO belonging only to HD 1.2 may be reduced significantly in severity if means are available to rapidly flood the vessel. In such a case, a lesser distance of 60 m may be acceptable

29. **HD 1.3.** For HD 1.3, a minimum separation distance of 60 m is to be used whether the PES is traversed or untraversed and for any quantity of EO.

30. **HD 1.4.** When the cargo comprises only EO of HD 1.4, vessels are to be separated by a minimum distance of at least 25 m for any quantity of EO whether the vessel is traversed or untraversed.

31. **Piers and jetties.** The distances specified in paragraphs 26 – 30 should also be used for protection of untraversed EO on piers and jetties from vessels (both traversed and untraversed) loaded with EO.

Protection from Vessels Loading or Unloading Explosive Ordnance

32. Vessels loading or unloading EO of HD 1.1 that are treated as untraversed. SD3–distances will provide Protection Level A to other vessels containing EO, whether they be traversed or untraversed, based on the greatest NEQ in the vessels concerned.

33. Because of the increased risk of accidents in handling EO, the greater protection of SD4–distances should be considered. Such distances will limit damage to unrelated vessels to that of a very minor nature, and virtually eliminate death and serious injuries.

34. HD 1.2, 1.3, and 1.4: For EO of HD 1.2, 1.3 or 1.4, the QD given in paragraphs 28, 29 and 30 respectively apply.

35. **Anchorages, piers and jetties.** The distances of paragraphs 32 - 34 are also to be observed between a vessel loading or unloading at an anchorage, and an EO pier or jetty.

Protection of other Berthed Cargo Vessels

36. The protection of other berthed cargo vessels depends on the type of EO stored or being loaded or unloaded. QD from vessels being loaded or unloaded with EO are as follows:

a. **HD 1.1.** For EO of HD 1.1, SD4–distances given in table 4G–1 are preferred. These distances provide a level of protection better than Protection Level A, in that they limit damage to that of a very minor nature and virtually eliminate death and serious injuries. If space limitations prohibit these distances, SD3–distances can be used. This closer spacing will provide Protection Level A. Special considerations may be required to afford greater separation for tanker vessels with unusually sensitive cargoes. In general, tankers should be afforded as much separation as practicable.

b. **HD 1.2.** For HD 1.2 EO, protection will depend on the types of EO involved and the likely hazard from fragments and lobbed EO (see Regulation 5.4 Annex A, paragraphs 8–14). A minimum distance of 90 m is to be used when EO of HD 1.2.2. A minimum distance of 135 m is to be used when EO of HD 1.2.1. These distances are constant for any quantity of EO and apply whether the vessel is traversed or untraversed.

c. **HD 1.3.** For HD 1.3 EO, SD1–distances given in table 4G–1 are to be used whether the EO vessel is traversed or untraversed. Minimum separation is 60 m.

d. **HD 1.4.** When the cargo comprises only HD 1.4, minimum separation distance of 25 m from other cargo vessel is to be used. This is constant for any quantity of EO, and applies whether the EO vessel is traversed or untraversed.

Protection of Explosive Ordnance Workshops

37. The separation distances from all vessels loaded or vessels loading or unloading EO to an EO workshop are given in Regulation 5.4 Annex A, paragraphs 26–31, based on the aggregated NEQ within the vessel and on the adjacent transfer area. The distances are intended to provide a reasonable degree of immunity for personnel within the explosives workshops from the effects of a nearby explosion. Light structures are likely to be severely damaged. These distances provide a high degree of protection against immediate or subsequent propagation of explosion.

Protection of Holding Areas

38. Separation from loaded vessels or vessels loading or unloading EO to holding areas containing road or rail trucks and wagons of EO are the SD3–distances given in table 4G–1 for traversed and untraversed vessels, based on the NEQ within the vessels and on the adjacent transfer area.

Protection of Inhabited Buildings

39. Traversed or untraversed vessels carrying or loading or unloading EO should be separated from inhabited buildings by the appropriate QD given in Regulation 5.4 Annex A. However, if the vessel contains EO of Hazard Division 1.2 only, and can be flooded, a minimum distance of 180 m may be used instead of the D1-distances in Regulation 5.4 Annex A, Appendix 1 Table 1A1-2. Similarly, a minimum distance of 270 m may be used instead of the D2-distances given in Regulation 5.4 Annex A, Appendix 1 Table 1A1-2.

Protection of Public Traffic Routes and Main Shipping Routes

40. All vessels carrying EO when not under way should, where practicable, be separated from public traffic routes (including main shipping routes) by the appropriate QD given in Regulation 5.4 Annex A. If the vessel only contains EO of Hazard Division 1.2, and can be flooded, a minimum distance of 90 m may be used instead of the D1-distances given in Regulation 5.4 Annex A. Similarly, a minimum distance of 135 m may be used instead of the D2-distance given in Regulation 5.4 Annex A, Appendix 1 Table 1A1-2.

Protection of Port Facilities

41. The QD in paragraph 39 are to be used in port areas to separate ships and vessels carrying EO from administration offices, workshops and warehouses containing valuable items which must be protected.

Scuttling areas

42. Safe areas may be designated at ports for handling of Defence EO to which vessels carrying Defence EO should, if possible, be directed or towed in the event of circumstances leading to a decision to scuttle. Where a scuttling areas is designated it should be selected at the appropriate QD from ES, and in sufficient depth of water to ensure complete swamping of Defence EO holds at all states of the tides. Calculation should be based on the largest NEQ likely to be in a single vessel handled at the port and the QD should be measured from the boundaries of the designated scuttling area. The scuttling area will normally be one of the approved licensed berths or buoys.

43. Safe Areas and/or Scuttling Areas are to be selected at ports at which naval vessels operate, to permit a range of dangerous EO scenarios to be dealt with, for example:

a. At Scuttling Areas - an uncontrolled fire or similar threat on a warship or ammunition lighter that threatens embarked stocks,

b. At Safe Areas - a handling incident during ammunitioning operations that results in EO becoming dangerous and requiring that it be destroyed in-situ, and

c. At Safe Areas - a collision or similar incident that requires the embarked EO to be checked for safety before being disembarked.

44. The selection of Safe and Scuttling Areas is to be undertaken by the Master Attendant together with representatives from the applicable Civilian Port Authority and the LA. Arrangements are to be made at the following Ports for the selection of Safe and /or Scuttling Areas, as appropriate, and preparation of associated contingency plans:

a. Adelaide, SA

b. Brisbane, QLD

c. Cairns, QLD – HMAS Cairns

d. Darwin, NT

e. Eden, NSW

f. Fremantle, WA

g. Rockingham, WA – HMAS Stirling

h. Hobart, TAS

i. Jervis Bay, NSW

j. Pt Alma, QLD

k. Pt Kembla, NSW

l. Sydney, NSW – Fleet Base East – HMAS Waterhen

m. Townsville, QLD

45. Safe Areas are to be selected at the appropriate quantity distances from ES based on calculations for the largest NEQ likely to be in a single vessel operated at the port. Scuttling Areas should also be selected on the same quantity distance basis as for Safe Areas. This requirement however, is not mandatory so as to permit the widest flexibility in planning for their use in an emergency. Scuttling Areas are to be selected over a sufficient depth of water to ensure complete swamping of EO holds at all states of tides. Quantity distances should be measured from the boundaries of the designated Safe or Scuttling Areas. A Safe or Scuttling Area may be one of the approved licensed berths or buoys.

46. When a Safe Area is proposed to be activated following an incident involving EO, the Safe Area must be licensed before any activities involving EO commence.

47. The location of Safe and Scuttling Areas and their method of utilisation are to be clearly set out in relevant operational orders and in maritime Disaster Plans for the port in question. These Disaster Plans should be exercised on a regular basis.

Berthing of Vessels Carrying Explosive Ordnance and POL at POL Jetties

48. SD4-distances given in the SD table 4G-1 must be observed to land based POL sites when ships carrying EO are berthed alongside POL jetties. If practicable, the minimum distance of 450 m for protection of above ground unprotected POL steel tanks should be observed.

49. When POL is being loaded or discharged no activities involving EO are to take place and hatches are to be firmly secured. Similarly, POL is not to be embarked or disembarked when EO handling is taking place.

ANNEX G

Compatibility Group Mixing Afloat

50. EO is to be mixed in stowage on board HMA warships and submarines in accordance with the Hazard Classification Code (HCC) system detailed in ABR 862 Volume 2, Chapter 3.

51. Consignments of EO transported by watercraft, e.g. Ammunition Lighter, along waterways are to be assembled in accordance with the compatibility group mixing requirements for road transportation given in Regulation 3.2 Procedure 1.

Licensing of Explosive Ordnance Berths, Buoys or Anchorages

52. As with above-ground sites that contain EO it is necessary to license (in accordance with Regulation 5.2 Procedure 1) each berth, buoy or anchorage either where EO may be handled, loaded/unloaded or where certain types of vessels containing EO may be berthed (see paragraph 5). The explosives limit of the licence is calculated by measuring the distance between the berth, buoy or anchorage and the various exposed sites in the vicinity. By using table 4G-1 and Regulation 5.4 Annex A, the maximum NEQ allowable, to give each ES the necessary protection, is obtained. Each ES is considered separately and the licensed limit at a berth is determined by the lowest NEQ needed to ensure that every ES receives its appropriate level of protection.

Quantity Distances in Periods of Declared Emergency

53. In periods of declared emergency (PODE) there may be occasions when it is required to carry out a specific operation in circumstances which do not permit the use of the provisions of Protection Level A. For PODE-related activities, a limited degree of protection against immediate propagation of an explosion as the general rule is deemed reasonable. Greater protection however, should continue to be given to vital facilities and POL tanks.

54. Table 4G-3 is a summary of quantity distances to be observed for seagoing vessels loaded with, or loading or unloading EO of Hazard Division 1.1 in ports and waterways in PODE.

PROTECTION OF THE GENERAL PUBLIC AND OTHER NON EXPLOSIVE EXPOSED SITES

Schools and Hospitals

55. Schools, hospitals and similar institutions must not be sited at less than the full inhabited building distance ($22.2Q^{1/3}$) when occupied.

Facilities of Vulnerable Construction

56. Facilities of vulnerable construction or public importance (Group V, as defined in Regulation 5.4 Annex A) must not be sited at less than $33.3Q^{1/3}$, but these will require individual assessment.

Ordinary Facilities of Conventional Design

57. Ordinary facility of conventional design should in general not be sited at less than $16.7Q^{1/3}$ separation distances. However, a few isolated facilities may be acceptable between SD3 and $16.7Q^{1/3}$ distances provided that no unacceptable fatality levels are generated as a result. It may also be necessary for such facilities beyond $22.2Q^{1/3}$ to be taken into account if there are areas of high density development. Any facility of unconventional design will have to be assessed separately. The term ‘ordinary facility of conventional design’ includes the following types of facilities:

a. one or two storey housing of conventional brick wall design;

b. public houses;

c. dock offices, customs offices etc; and

d. factories, offices and facilities with personnel that are not in any way associated with the handling of EO.

ANNEX G

Personnel Working in the Open and Not Involved with the Explosives Shipment

58. Personnel working in the open and not involved with the EO shipment should not be exposed at separations less than $11.1Q^{1/3}$.

Canteens

59. Canteens should in general not be sited at less than $11.1Q^{1/3}$ provided they are occupied by less than 50 people. If they are occupied by more than 50 people they should in general not be sites at less than $16.7Q^{1/3}$ distances. They may be ignored of they are likely to be unoccupied during the actual EO handling operations.

Passenger Terminals and Passenger Ships

60. Passenger terminals and passenger ships when embarking or disembarking should not be sited at less than $22.2Q^{1/3}$ when EO is being handled, and $16.7Q^{1/3}$ from ships loaded with EO where EO is not being handled. Any open areas over which passengers are likely to pass should not in general be sites at less than $11.1Q^{1/3}$.

61. Other ships not loaded, or with non-dangerous cargoes and having resident personnel on board, should be sited at not less than $11.1Q^{1/3}$.

Roads and Railways

62. Roads giving access to the berth may be ignored but the density of the traffic on all other roads should be assessed. If the density of traffic is very high then they should not be sited at less than $16.7Q^{1/3}$. If the density is very low the road should not be sited at less than $11.1Q^{1/3}$. All other roads should not in general be sited at less than $8.0Q^{1/3}$.

63. Railways used for goods traffic in the dock area may be ignored. Main line or busy suburban passenger train routes should not be sited at less than $16.7Q^{1/3}$. All other passenger routes should not in general be sited at less than $11.1Q^{1/3}$.

Bulk Carrier Ships carrying Significant Quantities of Non-Explosive Dangerous Goods

64. Bulk carries carrying significant quantities of Non Explosive Dangerous Goods (NEDG) should not be berthed at less than $11.1\ Q^{1/3}$. Consideration may be required for special loads.

Bulk Above-Ground Petroleum, Oil and Lubricant Storage Installations

65. Bulk above ground petroleum, oil, lubricant (POL) storage installations should not be sited at less than $11.1Q^{1/3}$ provided that the tanks are contained effectively in a bund. Special attention should be paid to Petroleum Spirit, LNG and LPG tanks which should not generally be sited at less than $16.7Q^{1/3}$ distances.

Transit Sheds

66. Transit Sheds and other installations used for the storage of significant quantities of highly flammable materials should not be sited at less than $16.7Q^{1/3}$. Such facilities containing NEDG should not be sited at less than $11.1Q^{1/3}$. If the facility is used for the storage of inert materials and has no personnel it may be ignored. If the facility contains personnel is should not in general be sited at less than $10.7Q^{1/3}$. However, lesser distances may be acceptable if the facility is of substantial construction or the numbers of personnel employed in the facility are very low.

67. No activities involving EO are to take place and hatches are to be firmly secured when POL is being loaded or discharged. Similarly, POL is not to be embarked or disembarked when EO handling is taking place.

ANNEX G

Net Explosives Quantity (NEQ) in kg	Quantity distances in metres			
	SD1	SD2	SD3	SD4
500	60	39	135	130
600	60	41	135	135
700	60	43	135	145
800	60	45	135	150
900	60	47	135	155
1000	60	48	135	160
1200	60	52	135	175
1400	60	54	135	180
1600	60	57	135	190
1800	60	59	135	195
2000	60	61	135	205
2500	60	66	135	220
3000	60	70	135	235
3500	60	73	135	245
4000	60	77	135	255
5000	60	83	140	275
6000	60	88	150	295
7000	62	92	155	310
8000	64	96	160	320
9000	67	100	170	335
10 000	69	105	175	345
12 000	74	110	185	370
14 000	78	120	195	390
16 000	81	125	205	405
18 000	84	130	210	420
20 000	87	135	220	435
25 000	94	145	235	470
30 000	100	150	250	500
35 000	105	160	265	530
40 000	110	165	275	550
50 000	120	180	295	590
60 000	130	180	315	630
70 000	135	200	330	660
80 000	140	210	345	690
90 000	145	220	360	720
100 000	150	225	375	750
120 000	160	245	395	790
140 000	170	250	420	840
160 000	175	265	435	870
180 000	185	275	455	910
200 000	190	285	470	940
250 000	205	305	510	1020
300 000	215	325	540	1080
350 000	230	340	570	1140
400 000	240	355	590	1180
500 000	255	380	640	1280
1 000 000	320	480	800	1600
Distance Functions	**3.2 NEQ ^{½}**	**4.8 NEQ$^{1/3}$**	**8.0 NEQ$^{1/3}$**	**16.0 NEQ$^{1/3}$**

Note

(a) Quantity distances for inhabited buildings and public traffic routes (including main shipping routes) are given in Regulation 5.4 Annex A, paragraphs 1.32–49.

Table 4G-1: Quantity distance table for vessels

ANNEX G

Exposed Site	Potential Explosion Site			
	Vessels loaded with EO		Vessels loading or unloading EO	
	Traversed	Untraversed	Traversed	Untraversed
Vessels loaded with EO	SD3[(a)]	SD3[(a)] (135 m minimum)	SD4[(b)]	SD4[(b)]
Vessels loading or unloading EO	SD4[(b)]	SD4[(b)]	SD4[(b)]	SD4[(b)]
Other cargo vessels	SD4[(b)]	SD4[(b)] (180 m minimum)	SD4[(b)]	SD4[(b)] (180 m minimum)
Port Facilities	[(c)]	[(c)]	[(c)]	[(c)]
Inhabited Buildings	[(c)]	[(c)]	[(c)]	[(c)]
Public Traffic Routes and Main Shipping Routes	[(c)]	[(c)]	[(c)]	[(c)]
EO Workshops	[(c)]	[(c)]	[(c)]	[(c)]
Holding Areas	SD3	SD3	SD3	SD3
POL Jetties	SD4[(b)]	SD4[(b)]	SD4[(b)]	SD4[(b)]

Note

(a) Ships moored in tandem may use SD2–distances.

(b) May be reduced to SD3 provided the exposed vessels are under military control and the controlling authority determines the exposure to be operationally necessary.

(c) Quantity distances in Regulation 5.4 Annex A, Appendix 1, table 1A1–1, inhabited building and public traffic routes.

Table 4G-2: Summary of quantity distances to be observed for seagoing vessels loaded with or loading or unloading explosive ordnance of Hazard Division 1.1 in naval ports

ANNEX G

Exposed Sites	Potential Exposed Site			
	Vessels Loaded with EO		Vessels Loading, Unloading or Handling EO	
	Traversed	Untraversed	Traversed	Untraversed
Vessels Loaded with EO	SD1 (b)	SD2 (b)	SD2 (b)	SD2 (b)
Vessels Loading or Unloading EO	SD2 (b)	SD2 (b)	SD2 (b)	SD2 (b)
Other Cargo Vessels	SD2	SD2	SD2	SD2
Port Facilities	SD3 (c)	SD3 (c)	SD3 (c)	SD3 (c)
Inhabited Buildings	SD3 (c)	SD3 (c)	SD3 (c)	SD3 (c)
Public Traffic Routes and Main Shipping Routes	SD2	SD2	SD2	SD2
EO Workshops and Holding Areas	0.5SD2 (2.4$Q^{1/3}$)	D7 (traversed ES) D9 (untraversed ES)	D7 (2.4$Q^{1/3}$)	0.5SD2 (traversed ES) SD2 (untraversed ES)
POL Jetties	SD3 (d)	SD3 (d)	SD3 (d)	SD3 (d)

Note

(a) The distances in this table provide a minimum standard of protection of Level B (ie a limited degree of protection against immediate propagation of an explosion).

(b) Vessels to be berthed in tandem to minimise fragment hazard.

(c) SD4 to vital facilities.

(d) SD4 to unprotected POL storage tanks subject to a minimum distance of 450 metres.

Table 4G–3: Summary of quantity distances to be observed for seagoing vessels loaded with or loading, unloading or handling EO of HD1.1 in ports and waterways during periods of declared emergency

ANNEX H

QUANTITY DISTANCES FOR FIELD STORAGE

INTRODUCTION

Scope

1. The principles in this annex apply to the storage of Explosive Ordnance (EO) in the theatre of operations (communications zone and combat zone) in field storage areas where the principles for storage in permanent depots cannot be applied and greater risks must be accepted. These principles are most important with respect to safety and protection of EO when stored under field conditions. These principles apply also to the parking of vehicles loaded with EO in the theatre of operations. Each vehicle or container is treated as a field stack module.

Exclusions

2. The following factors must also be considered, but are outside the scope of this manual and are left to the discretion of theatre commanders:

a. dispersion against attack,

b. ground pattern,

c. camouflage,

d. isolation,

e. communications,

f. expansion,

g. improvement,

h. security, and

i. sabotage.

3. These principles do not apply to EO storage depots established in peacetime to meet the need for holding war reserves, even though the depot may be under field conditions. The normal principles for storage apply to such situations.

Authorisation of field storage

4. Storage of EO under the conditions of this chapter is to be licensed as for all other EO activities and licences are to be approved by Deputy Chief Joint Operations (DCJOPS) or delegate.

FIELD STORAGE PRINCIPLES

General Principles

5. The amount of EO in the field camp must be limited to the minimum consistent with safe and efficient operations. There should be no EO in the field camp that does not support the mission.

6. Store the main amount of EO in a field storage site separated from the field camp. Transfer only the minimum EO to the field camp.

7. Modular storage of ammunition and explosives is mandatory in the field camp to limit the Maximum Credible Event to one Basic Module. Modular storage refers to a traversed area comprised of a series of cells separated from each other by traverses.

8. The NEQ per module should be kept as low as practically possible, consistent with the mission and the available separation distances.

Site Planning Principles

9. The function of a proper layout of an EO storage site is dual:

a. Internal safety must be guaranteed. The Basic Modules should be positioned in such a way that the probability of a sympathetic reaction of adjacent modules is minimised. Traverses around modules should always be used, since they considerably reduce minimum intermodule quantity distances necessary to prevent sympathetic detonations. Traverses function by stopping ammunition fragments and to protect the stored ammunition against external threats, like enemy fire.

b. If traverses are not available, the corresponding larger minimum IQD should be observed. If the prescribed minimum intermodule quantity distances can not be observed, the NEQ to calculate Inside Quantity Distances (IQD) and Outside Quantity Distance (OQD) is the sum of all NEQ of the Potential Explosion Sites (PES). As a result, IQD and OQD will be considerably larger. If these interior and outside minimum QD can not be observed, the safety of the troops and civilians inside these distances is compromised.

10. External safety must be optimal. Complying with the advised minimum QD to military and civil exposed sites results in an acceptable level of risk for military personnel and civilians. The OQD for military and civil exposed sites result in a layout of the total compound in which the most vulnerable Exposed Sites (ES), like unprotected lodging or administrative accommodations, are positioned further away from the PES than less vulnerable exposed sites, for instance protective shelters.

Selection of sites

11. Sites should be carefully selected taking account of the following requirements:

a. The ground must be firm to carry the heavy weight of EO stacks and laden vehicles.

b. The ground should be level, dry and pervious to water.

c. The site should be easily accessible, preferably on both sides of by-roads. Loading and unloading of vehicles should be capable of being accomplished away from main roads so that traffic is not hindered.

d. The site should be located sufficiently far from trees, telegraph poles, pylons, etc that a lightning strike to a tree, etc would not cause damage to the explosives.

e. A water supply should be available for firefighting.

f. Variations in terrain or a dense forest should be exploited to provide natural traverses.

g. Firebreaks of sufficient width should be planned and maintained to prevent a potential spread of fire. Roads of corresponding width are considered as firebreaks.

Limitations on gross weight

12. The limitations on gross weight adopted for the definitions of basic module, storage module, storage site and intermodule QD in the glossary of terms are based on the desire to ensure acceptable internal and external safety and to meet the logistic requirements in paragraphs 23–26 inclusive.

ANNEX H

SEPARATION AND SEGREGATION

Separation of hazard divisions

13. A storage module should contain EO of one Hazard Division (HD) only, except that any unoccupied portion of the site may be filled with EO belonging to HD 1.4. When this is not possible the following principles should apply:

a. When EO in HD 1.2 and 1.3 is stored together in the same storage module, the QD for each HD is assessed independently and the larger distance is observed.

b. When EO in HD 1.2 and/or 1.3 is stored in the same module as EO in HD 1.1, the whole storage module is to be regarded as HD 1.1 for the purpose of QD and the NEQ aggregated.

Segregation of different compatibility groups

14. EO of each compatibility group should be stored in a separate Field Storage Site. However, when it is necessary to store different compatibility groups together, only the following compatibility groups may be stored together on the same site:

a. Compatibility Groups C, D, E and G provided Compatibility Group G is in its approved packaging.

b. Hazard Classification Class 1.4S may be stored with:

(1) Any one of the Compatibility Groups B, C, D, E, F, G, H or J; and

(2) Any combination of Compatibility Group C, D, E and G provided Compatibility Group G is in its approved packaging.

c. Irrespective of it Compatibility Group, EO of 1.4 may be stored with:

(1) Any one of the Compatibility Group B, C, D, E, F or G; and

(2) Any combination of Compatibility Group C, D, E and G provided Compatibility Group G is in its approved packaging.

d. Fuzes in Compatibility Group B may be stored with articles to which they are assembled, but the NEQ must be aggregated and treated as Compatibility Group F.

15. The following Compatibility Groups must be stored in separated Field Storage Sites:

a. Detonators in Compatibility Group B.

b. Compatibility Group F is to be stored in a separate site from other Compatibility Groups, except that Compatibility Group F may be stored in the same site as HD 1.4 irrespective of Compatibility Group.

c. Compatibility Group H is to be stored in a separate site from other Compatibility Groups, except that Compatibility Group H may be stored in the same site as HD 1.4S.

d. Compatibility Group J is to be stored in a separate site from other Compatibility Groups, except that Compatibility Group J may be stored in the same site as HD 1.4S.

e. Compatibility Group K.

f. EO in Compatibility Group L. (Within this Compatibility Group, different types of EO should be stored separately.)

Additional requirements for segregation

16. EO should be stored so that not all one type of EO is lost in a fire or explosion involving a single storage site.

17. Individual modules should be limited to EO of one type and preferably of one lot/batch.

18. The following EO must not be stored with combat serviceable EO in the same module:

a. EO which has been returned from units but which has not been inspected.

b. EO in incomplete or damaged packages awaiting inspection and repacking.

c. Unserviceable EO.

d. EO, the use of which is forbidden.

e. EO awaiting disposal.

f. EO of unknown origin.

g. Recovered EO.

19. Storage sites should not be used for the storage of other commodities (including the empty packaging, accessories, and stacking materials), and the sites should be separated from other dangerous goods by adequate distances. Typical distances would be 100 m for packing material and 400 m for petrol, oil and lubricants.

Isolated storage

20. EO in Compatibility Group H (white phosphorous) should be at a site adjacent to a readily available supply of water. If water is not readily available from natural sources, then buckets and containers must be kept filled with water. A reserve of earth, or preferably sand, must also be provided in the immediate vicinity.

21. Rockets, rocket motors, and missiles in a propulsive state should be stored in a traversed site. If this is not possible then they should be stored in the most isolated parts of a field storage area and if possible, pointing away from other storage sites.

Destruction of explosive ordnance

22. EO and other dangerous goods sentenced for destruction must be destroyed as soon as possible after sentencing.

STORAGE CONDITIONS

23. In order to keep the EO in operational condition, the storage modules should give adequate protection against all weather conditions including lightning. A variety of equipment to achieve internal conditioning of the facility is available. The use of pallets to stack the EO is strongly advised to keep the goods free from the floor and thus dirt and mud to obtain maximum air circulation and ventilation.

Provision of protection against the weather

24. Some form of cover should be provided to protect EO against rain and the heating effect of sunlight. In tropical and hot conditions EO can be severely affected by the direct rays of the sun, and some degree of shade must be provided for all types of EO, the most effective protection being allotted to propellants, especially rocket motors. In extreme cold conditions cover should be provided to protect EO from exposure to ice and snow.

25. It is important that all reasonable efforts be made to ensure that items of EO are kept within the prescribed temperature limits as indicated in the items Design Limit Summary (Topic -026) and/or Lifing Data (Topic -024) where relevant. Where temperatures have exceeded the defined temperature limits, the incident is to be reported in accordance with Regulation 1.3.

26. When storage or environmental conditions are likely to contribute to EO temperatures reaching their prescribed limits, direct monitoring of their temperatures should be considered. This will determine if a more detailed assessment is required.

27. In the case where insufficient information or direction regarding protection of the EO from the elements exists, further advice should be sought from either the sustainment manager within the Explosive Materiel Branch.

28. When covered storage is not available for all types of EO, those likely to deteriorate most rapidly from the effect of the prevailing weather conditions must be given first priority for covered storage. Recommended priority order of EO types is contained within Regulation 4.1 Procedure 3.

29. Covers and improvised shelters should fulfil the following conditions:

a. The roof should protect against rain and sunlight.

b. Protective sides should be provided unless the roof overlaps sufficiently to prevent driving rain or direct sunlight affecting the EO.

c. All covers must be supported clear of the EO to allow full ventilation.

d. Materials should be as far as possible non-flammable or fire retardant.

30. Normal means of protection are:

a. tarpaulins,

b. locally improvised structures suitable for the theatre of operations,

c. galvanised iron shelters, and

d. ISO containers.

FIREFIGHTING FOR FIELD STORAGE

General

31. Firefighting principles and procedures are the same as those given for permanent depots in Manual of Fire Protection Engineering (MFPE). However, EO in field storage is more vulnerable to fire than when in permanent depots therefore appropriate importance should be placed on fire precautions and firefighting in field storages.

Symbols

32. Firefighting symbols, as shown in MFPE, appendix 1, annex A to chapter 17 must be displayed at each field storage site. Symbols are fixed to posts, clear of the EO and placed where they are easily seen by anyone approaching the site.

QUANTITY DISTANCES FOR FIELD STORAGE

Measurement of distances

33. In all cases, distances are measured from the nearest point of the potential explosion site (PES) to the nearest point of the exposed site (ES).

ANNEX H

Inside quantity distances for field storage

34. Minimum intermodule quantity distances for EO of HD 1.1, HD 1.2 and HD 1.3 necessary to prevent adjacent modules sympathetically detonating are given in the tables 4H–1 to 4H–4 as a function of HD and Maximum Credible Event. These distances do not cover asset preservation.

35. The use of effective traverses is highly recommended, because they:

a. protect the EO from external threats like enemy fire;

b. minimise explosion effects in case of an accidental explosion (traverses stop ammunition fragments); and

c. prevent sympathetic detonation of adjacent modules.

As a result, the application of effective traverses around storage modules will reduce the required surface area for a storage site considerably. Effective traverse designs are described in Regulation 6.1 Procedure 2.

36. Instead of conventional earth embankments which have certain slopes and which are therefore space consuming, 'big bags' or concertainers can be used (eg Hesco Bastion Concertainers). These concertainers must be filled with material (like sand) that stops EO fragments and that does not contribute to debris throw.

Figure 4H-1: Example of field traverses

37. In case of storage EO of HD 1.2 and HD 1.3 it is recommended that an effective roof construction be applied. The floor will protect the stored EO from external threats and minimise explosion effects (like EO fragments, lobbed EO, heat radiation), especially during the first minutes after alarm when evacuation of personnel will take place. Proposed effective roof construction for out- of-area circumstances are, for instance, earth covered plates of steel or concrete prefabricated slabs.

ANNEX H

Quantity Distances (m) for HD 1.1								
		500 kg NEQ	**1 ton NEQ**	**5 ton NEQ**	**10 ton NEQ**	**15 ton NEQ**	**20 ton NEQ**	**25 ton NEQ**
Untraversed	$D=4.8Q^{1/3}$	39	48	83	105	120	135	145
Traversed	$D=0.8Q^{1/3}$	7	8	14	18	20	22	24

Table 4H-1: Minimum intermodule quantity distances for Explosive Ordnance of Hazard Division 1.1 stored in ISO containers or equivalent

Quantity Distances (m) for HD 1.2							
	500 kg NEQ	**1 ton NEQ**	**5 ton NEQ**	**10 ton NEQ**	**15 ton NEQ**	**20 ton NEQ**	**25 ton NEQ**
Untraversed	10	10	10	10	10	10	10
Traversed	No QD	No QD	No QD	No QD	No QD	No QD	No QD
Traversed and protective roof	No QD	No QD	No QD	No QD	No QD	No QD	No QD

Table 4H-2: Minimum intermodule quantity distances for Explosive Ordnance of Hazard Division 1.2 stored in ISO containers or equivalent

Quantity Distances (m) for HD 1.3.3								
		500 kg NEQ	**1 ton NEQ**	**5 ton NEQ**	**10 ton NEQ**	**15 ton NEQ**	**20 ton NEQ**	**25 ton NEQ**
Untraversed	$D=0.44Q^{1/3}$	10	14	32	44	56	64	70
Traversed	$D=0.22Q^{1/3}$	5	7	16	22	28	32	35
Traversed and protective roof		No QD	No QD	No QD	No QD	No QD	No QD	No QD

Table 4H-3: Minimum intermodule quantity distances for Explosive Ordnance of Hazard Division 1.3.3 stored in ISO containers or equivalent

Quantity Distances (m) for HD 1.3.4							
	500 kg NEQ	**1 ton NEQ**	**5 ton NEQ**	**10 ton NEQ**	**15 ton NEQ**	**20 ton NEQ**	**25 ton NEQ**
Untraversed	10	10	10	10	10	10	10
Traversed	No QD	No QD	No QD	No QD	No QD	No QD	No QD
Traversed and protective roof	No QD	No QD	No QD	No QD	No QD	No QD	No QD

Table 4H-4: Minimum intermodule quantity distances for Explosive Ordnance of Hazard Division 1.3.4 stored in ISO containers or equivalent

Outside quantity distances for Storage Sites

38. Specific types of ES as they appear in the theatre of operations are redefined and classified into their vulnerability to explosion effects. They are subdivided into military and civil ones (see table 4H–5).

39. A field storage site should be located at distances from inhabited buildings, barracks and public transport routes etc that prevent such ES from being endangered more than is unavoidable under the circumstances. A field storage site should be separated from the nearest ES outside the area by at least the distances given in tables 4H–6 to 4H–11.

Exposed Site	Examples
Unprotected personnel	Personnel in: the open, standard vehicles, tents, light structures, field hospitals etc.
Semi-protected personnel	Personnel in strengthened structures: Accommodations in which normal glazing is replaced by air blast and bullet resistant glazing, accommodations which are equipped with bullet (SAA) resistant panels, strengthened roof constructions (eg earth covered 20 feet (ft) flattracks) etc.
Protected personnel	Personnel in: protective shelter (bunkers), armoured vehicles, that must be able to resist explosion effects like ammunition fragments and air blast with a peak incident overpressure of 21 kPa (corresponding with a protection level of 8.0 $Q^{1/3}$.
Unprotected petroleum, oil, lubricant (POL) installation	
Protected POL installation	POL installation with protective measures, eg Hesco Bastions and protective roof construction.
Unprotected civilians	People in open, houses, cars etc.
Chemical Industry	

Table 4H–5: Definitions of exposed sites in the outside military and civil zone

40. An example of a field protective shelter is shown in figure 4H–2. Protection is given by walls of Hesco Bastion Concertainers and a protective roof which is constructed of small Hesco Bastion Concertainers filled with sand, with on top of that a burster layer. Inside this heavy structure, a 20 ft ISO container is placed to offer personnel some comfort.

Figure 4H-2: Example of Protective Shelter

41. Minimum OQD for EO of HD 1.1, HD 1.2 and HD 1.3 are given in tables 4H–6 to 4H–11.

Quantity Distances (m) for HD 1.1								
Exposed Site	**Protection Level**	**500 kg NEQ**	**1 ton NEQ**	**5 ton NEQ**	**10 ton NEQ**	**15 ton NEQ**	**20 ton NEQ**	**25 ton NEQ**
Unprotected personnel	$D=22.2Q^{1/3}$	180	225	380	480	550	610	650
Semi-protected personnel	$D=14.8Q^{1/3}$	120	150	255	320	365	405	435
Protected personnel	$D=8.0Q^{1/3}$	64	80	140	175	200	220	235
Unprotected petroleum, oil, lubricant (POL) installation	$D=22.2Q^{1/3}$	180	225	380	480	550	610	650
Protected POL installation	$D=1.2Q^{1/3}$	10	12	21	26	30	33	36
Unprotected civilians	$D=22.2Q^{1/3}$	180	225	380	480	550	610	650
Chemical Industry	$D=22.2Q^{1/3}$	180	225	380	480	550	610	650

Table 4H-6: Minimum outside quantity distance from a Potential Explosion Site with Explosive Ordnance of Hazard Division 1.1

Quantity Distances (m) for HD 1.2.1								
Exposed Site	**Protection Level**	**500 kg NEQ**	**1 ton NEQ**	**5 ton NEQ**	**10 ton NEQ**	**15 ton NEQ**	**20 ton NEQ**	**25 ton NEQ**
Unprotected personnel	D2[(a)]	220	257	337	370	389	402	412
Semi-protected personnel	D6[(a)]	148	173	226	248	261	270	277
Protected personnel	N/A	No QD	No QD	No QD	No QD	No QD	No QD	No QD
Unprotected petroleum, oil, lubricant (POL) installation	D2[(a)]	220	257	337	370	389	402	412
Protected POL installation	N/A	No QD	No QD	No QD	No QD	No QD	No QD	No QD
Unprotected civilians	D2[(a)]	220	257	337	370	389	402	412
Chemical Industry	D2[(a)]	220	257	337	370	389	402	412

Note

(a) Refer Regulation 5.4 Annex A Appendix 1.

Table 4H-7: Minimum outside quantity distance from an unbarricaded open stack or light structure (eg ISO container) Potential Explosion Site with Explosive Ordnance of Hazard Division 1.2.1

Quantity Distances (m) for HD 1.2.2								
Exposed Site	**Protection Level**	**500 kg NEQ**	**1 ton NEQ**	**5 ton NEQ**	**10 ton NEQ**	**15 ton NEQ**	**20 ton NEQ**	**25 ton NEQ**
Unprotected personnel	D2[(a)]	75	88	123	141	152	160	166
Semi-protected personnel	D5[(a)]	60	60	83	95	103	108	112
Protected personnel	N/A	No QD	No QD	No QD	No QD	No QD	No QD	No QD
Unprotected petroleum, oil, lubricant (POL) installation	D1	75	88	123	141	152	160	166
Protected POL installation	N/A	No QD	No QD	No QD	No QD	No QD	No QD	No QD
Unprotected civilians	D1[(a)]	75	88	123	141	152	160	166
Chemical Industry	D1[(a)]	75	88	123	141	152	160	166

Note

(a) Refer Regulation 5.4 Annex A, Appendix 1.

Table 4H-8: Minimum outside quantity distance from an unbarricaded open stack or light structure (eg ISO container) Potential Explosion Site with Explosive Ordnance of Hazard Division 1.2.2

Quantity Distances (m) for HD 1.2.2								
Exposed Site	**Protection Level**	**500 kg NEQ**	**1 ton NEQ**	**5 ton NEQ**	**10 ton NEQ**	**15 ton NEQ**	**20 ton NEQ**	**25 ton NEQ**
Unprotected personnel	IBD	60	60	60	60	60	60	60
Semi-protected personnel	PTRD	60	60	60	60	60	60	60
Protected personnel	PBD	No QD	No QD	No QD	No QD	No QD	No QD	No QD
Unprotected petroleum, oil, lubricant (POL) installation	IBD	60	60	60	60	60	60	60
Protected POL installation	N/A	No QD	No QD	No QD	No QD	No QD	No QD	No QD
Unprotected civilians	IBD	60	60	60	60	60	60	60
Chemical Industry	IBD	60	60	60	60	60	60	60

Table 4H-9: Minimum outside quantity distance from the side and rear walls of earth covered Potential Explosion Site with Explosive Ordnance of Hazard Division 1.2.1 and Hazard Division 1.2.2)

Quantity Distances (m) for HD 1.3.3								
Exposed Site	**Protection Level**	**500 kg NEQ**	**1 ton NEQ**	**5 ton NEQ**	**10 ton NEQ**	**15 ton NEQ**	**20 ton NEQ**	**25 ton NEQ**
Unprotected personnel	$D=6.4Q^{1/3}$	51	64	110	140	160	175	190
Semi-protected personnel	$D=4.3Q^{1/3}$	35	43	73	92	110	120	125
Protected personnel	$D=3.2Q^{1/3}$	26	32	55	68	80	87	94
Unprotected petroleum, oil, lubricant (POL) installation	$D=6.4Q^{1/3}$	51	64	110	140	160	175	190
Protected POL installation	$D=3.2Q^{1/3}$	26	32	55	68	80	87	94
Unprotected civilians	$D=6.4Q^{1/3}$	51	64	110	140	160	175	190
Chemical Industry	$D=6.4Q^{1/3}$	51	64	110	140	160	175	190

Table 4H-10: Minimum outside quantity distance from a Potential Explosion Site with Explosive Ordnance of Hazard Division 1.3.3

Quantity Distances (m) for HD 1.3.4								
Exposed Site	**Protection Level**	**500 kg NEQ**	**1 ton NEQ**	**5 ton NEQ**	**10 ton NEQ**	**15 ton NEQ**	**20 ton NEQ**	**25 ton NEQ**
Unprotected personnel	N/A	51	64	110	140	160	175	190
Semi-protected personnel	N/A	No QD	No QD	No QD	No QD	No QD	No QD	No QD
Protected personnel	N/A	No QD	No QD	No QD	No QD	No QD	No QD	No QD
Unprotected petroleum, oil, lubricant (POL) installation	$D=6.4Q^{1/3}$	51	64	110	140	160	175	190
Protected POL installation	$D=3.2Q^{1/3}$	26	32	55	68	80	87	94
Unprotected civilians	$D=6.4Q^{1/3}$	51	64	110	140	160	175	190
Chemical Industry	$D=6.4Q^{1/3}$	51	64	110	140	160	175	190

Table 4H-11: Minimum outside quantity distance from a Potential Explosion Site with Explosive Ordnance of Hazard Division 1.3.4

42. The statements in the table 4H–12 apply under the precondition that by means of protective measures it has been ensured that the worst case of a NEQ of 4000 kg of HD 1.1 may detonate at once in an EO container. It is assumed that temporary structural protective measures, traverses or other barriers exist at the PES. The ES must be protected by protective roofs especially against fragments and projections. The minimum range detailed in table 4H–12 are laid down in a way that the direct and indirect consequences of an occurrence of damage will not lead to a catastrophe.

ANNEX H

Minimum Range (m)	Tolerable Activities	Risk Level	Expected Consequences in case of an Explosion
350	Built up areas	Minor	Projections and breaking glass
250	Billets if structural protection is available. Scattered buildings. Public Roads.	Minor	Injuries caused by projections, collapse and breaking glass
150	Billets if structural protection against projections, breaking glass, and collapse is available. Unprotected personnel in the open: 50 maximum, temporarily. Public roads: low density.	Major	Injuries caused by fragments and projections. Fatalities
100	Personnel in the open with individual protective equipment: 20 maximum, for a short time. Continuous parking of armoured vehicles, temporary parking of vehicles. Storage of materiel. Maintenance work if structural protection is available.	Major	Injuries caused by fragments and projections. Fatalities
50	Guard personnel: 10 maximum, continuously. Structural protection against projections and collapse. Parking of armoured vehicles for a short time.	Major	Injuries caused by fragments and projections. Fatalities
<50	Handling of EO: two to six persons and vehicles for a short time.	Catastrophic	Fatalities

Table 4H–12: Tolerable activities in case there is a small probability of an accidental explosion of 4000 kg Net Explosives Quantity of Hazard Division 1.1

PROCEDURE 1 - APPLICATION OF QUANTITY DISTANCES

APPPLICATION OF THE QUANTITY DISTANCE TABLES AT AN EXISTING STORAGE AREA

General

1.1 This annex provides examples intended only as a guide to the use of Quantity Distance (QD) tables. The size of buildings and their arrangement are not significant.

1.2 Net Explosives Quantity (NEQ) are expressed in kilograms (kg) and QD are in metres (m).

Definitions and Pictographs

1.3 For the purposes of the example the definitions and pictographs in table 1–1 are used:

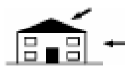
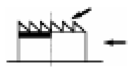
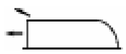
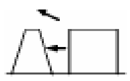
Term	Definition	Pictograph
Inhabited Building		
Public Traffic Route (PTR)		
Process Building	Process building with or without a protective roof, untraversed.	
Earth covered building (ECB)	Building with earth on the roof and against three walls. Directional effects through the door and headwall are towards an Explosion Site (ES).	
Traversed site	Open stack or a lightweight building with traverse, constructed with walls of up to 395 mm brick cavity and roof of up to 150 mm reinforced concrete.	
Sparsely populated area	An area populated by a maximum of 25 people.	

Table 1–1: Applicable Definitions and Pictographs

1.4 It is emphasised that the definitions of sparsely populated area and Low Traffic Density are for the purposes of the following example only.

1.5 Figure 1-1 is a plan of a small storage complex. Determine the NEQ of each hazard division (HD) for the Explosives Storage House (ESH), the open stack, and the process building.

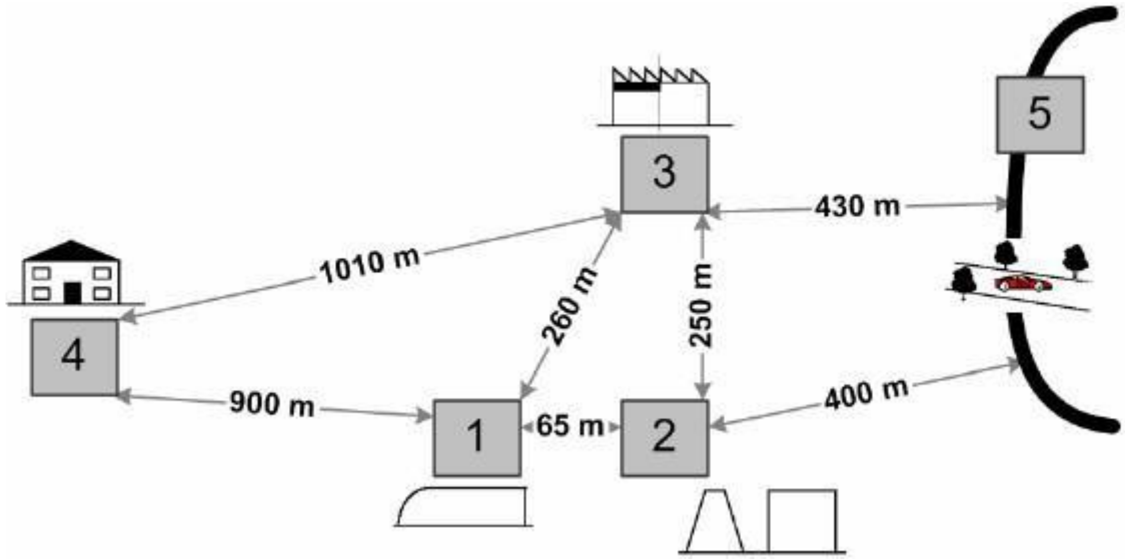


Figure 1–1: Layout of Example Storage Complex

Notes:

a. The explosives storage sites (1) and (2) are both 20 m x 13 m.

b. The process building (3) is of light construction.

c. Inhabited building (4) is an unstrengthened multistorey office building in which 150 people work.

d. ESH 1 is a traversed earth covered building (the symbol above represents ESH 1 considered as a Potential Explosion Site (PES)).

e. Fire fighting arrangements are adequate.

f. Open stack (2) is traversed on all sides.

g. The road (5) has single lanes and carries approximately 40 vehicles per hour.

h. Arrows to indicate if a site is a PES or ES have been removed from pictographs.

1.6 The procedure is basically to consider each PES in turn with relation to all ES. From this consideration will emerge which ES limits the NEQ in the particular PES being considered.

1.7 In this example intermediate distances between those given in the tables are treated in each case in accordance with Regulation 5.4 Annex A paragraph 51. In each case the NEQ has been rounded down.

Consider Storage Site 1 as a Potential Explosion Site

1.8 The ECB (1) is traversed and has an unspecified headwall and door. The presence of a traverse is irrelevant when considering the earth covered building as a PES, in spite of Regulation 5.4 Annex A paragraph 114, which is not taken into account when considering earth covered buildings as PES.

The orientation of the earth covered building relative to each Exposed Site must be considered

1.9 Reference to the layout shows that ECB (1):

a. has its door and headwall facing both the open stack (2) and the road (5);

b. is side on to the process building (3); and

c. has its door and headway away from the inhabited building (4).

Consider the Exposed Site relative to the earth covered building

1.10 The ES relative to the PES are;

a. The process building which is of light construction and is untraversed.

b. The inhabited building is a densely populated area. Attention is drawn to Regulation 5.4 Annex A paragraphs 155–59 which recommends that with populated buildings a minimum of 400m should be used.

c. The road (5) is a single lane road that is considered to have low density traffic.

d. The open stack (2) is traversed on all sides and measures 20 m x 13 m.

Consider the distance of each Exposed Site from the Potential Explosion Site

1.11 These distances are taken from the site layout and are:

a. ECB (1) to open stack (2)—65 m

b. ECB (1) to process building (3)—260 m

c. ECB (1) to road (5)—485 m (i.e. 400 m + 65 m + 20 m (width of open stack)); and

d. ECB (1) to inhabited building (4)—900 m.

Calculate the Net Explosives Quantity for Hazard Division HD 1.1

1.12 Refer to Regulation 5.4 Annex A Appendix 1 table 1A1–1 of and consider each of the ES in turn, in each case the relevant PES column has to be used.

a. ECB (1) to open stack (2)—column f, row 14 results in the D7 distance (without restriction of types of ammunition and explosives being stored) which equates to 18 000 kg NEQ for a distance of 65 m.

b. ECB (1) to process building (3)—column b, row 18 results in the D10 distance (with a minimum of 270 m) which means that no explosive ordnance (EO) of HD 1.1 may be stored in ECB (1). Since the NEQ is nil, in practice there would be no need to continue the calculations for HD 1.1. For the purpose of this exercise the calculations are continued to demonstrate the method of work for the other ES.

c. ECB (1) to Road (5)—column f, row 19 results in the D11 distance (with a minimum of 270 m) since the road is deemed as having median traffic density in accordance with Regulation 5.4 Annex A, paragraph 131a. (2). D11 gives 35 000 kg NEQ for a distance of 485 m.

d. ECB (1) to inhabited building (4)—the separation distance is 900 m, but since a facility of group V (see Regulation 5.4 Annex A, paragraph 157) is involved, a distance of 900 m x ½ = 450 m must be used in the calculation of permissible NEQ. Column a, row 20 gives D13 distance with a minimum of 400 m. Reference to D13 gives 8 000 kg for a distance of 450 m.

The maximum permissible NEQ for HD 1.1 is nil.

Calculate the Net Explosives Quantity for Hazard Division HD 1.2

1.13 Regulation 5.4 Annex A paragraph 1.8 states that before appropriate QD can be selected, there are two factors to be considered. The first is the range of fragments and lobbed EO that may be projected from a PES in an explosive event. The second is the total number of such projections likely to hazard an ES. Regulation 5.4 Annex A, paragraph 1.9 states that the range of fragments and lobbed EO can be classified as more hazardous items of EO being of HD 1.2.1 and the less hazardous items of EO being of HD 1.2.2. Attention is drawn to Regulation 5.4 Annex A, paragraph 165b. which states that when different types of HD 1.2 are kept in the same site the required HD is that given for the aggregate quantity taken as the more hazardous type, HD 1.2.1.

1.14 For the purposes of this example the calculations have been made on the basis of the ECB (1) containing either HD 1.2.1 or HD 1.2.2.

1.15 Refer to Regulation 5.4 Annex A Appendix 1 table 1A1–1 and consider each of the ES in turn, in each case the relevant PES column has to be used.

a. ECB (1) to open stack (2)—column b, row 6 results in the use of either D7 or D8 distances for limited protection, or D5 and D6 for high levels of protection depending on the nature of HD 1.2. 65 m for D7 and D8 allow 2500 kg HD 1.2.1 and virtually unlimited HD 1.2.2. D5 and D6 give 50 kg of HD 1.2.1 and 1600 kg of HD 1.2.2.

b. ECB (1) to process building (3)—column a, row 9 results in No QD with a high degree of protection for personnel and a practical considerations to dictate specific separation distances. Therefore unlimited HD 1.2.1 and HD 1.2.2 may be stored in ECB (1).

c. ECB (1) to Road (5)—column b row 10 results in the distance D1 since the road is deemed as having median traffic density. D1 gives unlimited NEQ for a distance of 485 m.

d. ECB (1) to inhabited building (4)—the separation distance is 900 m. Column a, row 11 gives a fixed distance of 30 m or 60 m, depending on the nature of HD 1.2 of no QD Therefore unlimited NEQ of HD 1.2.1 and HD 1.2.2 may be stored in ECB(1).

The maximum permissible NEQ for HD 1.2 is 2500 kg with limited protection against propagation.

Calculate the Net Explosives Quantity for Hazard Division HD 1.3

1.16 Regulation 5.4 Annex A, paragraph 15 states that before appropriate QD can be selected the separate consideration of two subdivisions needs consideration. The first is the more hazardous items of EO that are classified as HD 1.3.3 and are more likely to be bulk packed gun propellants which produce a fireball with intense radiant heat, firebrands and some fragments. The less hazardous items of HD 1.3 not producing a mass fire effect that burn sporadically and are more likely to produce minor projections and firebrands along with some limited thermal effects are classed as HD 1.3.4.

1.17 For the purposes of this example the calculations have been made on the basis of the ECB (1) containing either HD 1.3.3 or HD 1.3.4.

1.18 Refer to Regulation 5.4 Annex A Appendix 1 table 1A1-3 for HD 1.3.3 and consider each of the ES in turn, in each case the relevant PES column has to be used.

a. ECB (1) to open stack (2)—column f, row 14 results in a QD of 240 m. Since only 65 m are available no EO of HD 1.3.3 may be stored in ECB (1). Since the NEQ is nil, in practice there would be no need to continue the calculations for HD 1.3.3. For the purpose of this exercise the calculations are continued to demonstrate the method of work for the other ES.

b. ECB (1) to process building (3)—column b, row 16 results in D2 distances. Therefore for 260 m the allowable NEQ in ECB (1) of HD 1.3.3 is over 250 000 kg.

c. ECB (1) to Road (5)—column f, row 19 results in the D4 distance (with a minimum of 270 m). D4 gives over 250 000 kg NEQ of HD 1.3.3 for a distance of 485 m.

d. ECB (1) to inhabited building (4)—column a, row 20 gives a D4 distance which, for a distance of 900 m, allows greater than 250 000 kg NEQ of HD 1.3.3.

The maximum permissible NEQ for HD 1.3.3 is nil.

1.19 Refer to Regulation 5.4 Annex A Appendix 1 table 1A1-4 for HD 1.3.4 and consider each of the ES in turn, in each case the relevant PES column has to be used.

a. ECB (1) to open stack (2)—column f, row 14 results in a minimum distance of 60 m. Since 65 m are available 1000 kg NEQ of EO of HD 1.3.4 may be stored in ECB (1).

b. ECB (1) to process building (3)—column b, row 16 results in a minimum distance of 25 m. Therefore for 260 m available the allowable NEQ in ECB (1) of HD 1.3.4 is 60 000 kg.

c. ECB (1) to Road (5)—column f, row 19 results in the D4 distance. D4 gives over 250 000 kg NEQ for a distance of 485 m for HD 1.3.4.

d. ECB (1) to inhabited building (4)—column a, row 20 gives a D4 distance which, for a distance of 900 m, allows greater than 250 000 kg NEQ of HD 1.3.4.

The Net Explosives Quantity for Hazard Division HD 1.4

1.20 EO of HD 1.4 may be added to ESH (1) up to it's physical capacity with out affecting the QD requirements (see Regulation 5.4 Annex A paragraph 165).

Further Calculations

1.21 The calculations are completed for ESH (1) regarded as a PES. Calculations are now required for open stack (2) and process building (3) as PES. These calculations are carried out in a similar manner, but the calculations are not detailed in this example.

1.22 It is again emphasised that this is only an example to demonstrate the application of the QD tables. A storage site such as the example may be uneconomical as only 2500 kg of HD 1.2 and 1000 kg NEQ of HD 1.3.4 are allowed, this would likely be a waste of an earth covered, barricaded building.

EXAMPLE OF THE USE OF THE QUANTITY DISTANCE TABLES FOR PLANNING OF A NEW STORAGE AREA

General

1.23 The aim of this example is to demonstrate the use of QD tables in the design of a new small ammunition depot.

1.24 A plot of ground is owned by the Department of Defence and the intention is to use it for a small ammunition depot. A sketch of the ground available and of neighbouring facilities is shown in figure 1–2.

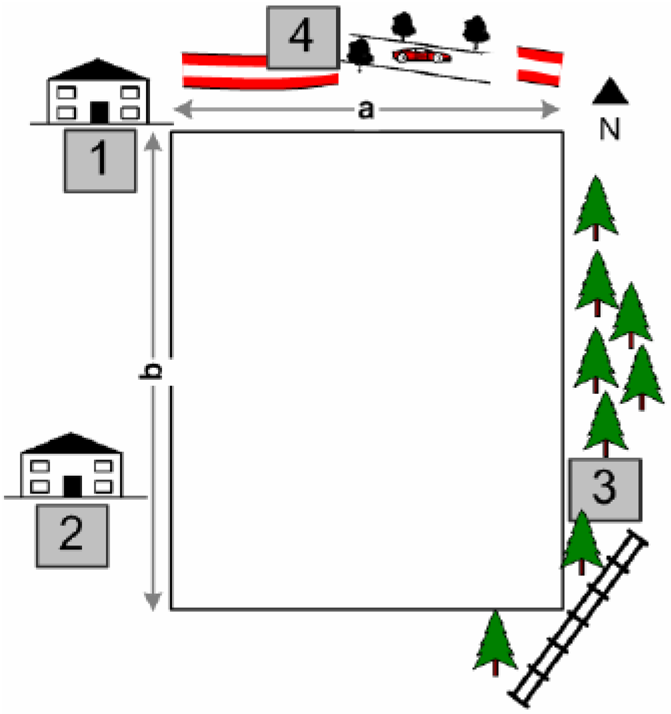


Figure 1–2: Sketch of Ground available and surrounding facilities

Notes:

a. Inhabited Building (1).

b. Inhabited Building (2).

c. Railway (3), used for passenger traffic.

d. Public Traffic Route (4), dual lane freeway.

1.25 The depot is required to hold the following:

a. 40 000 kg NEQ of HD 1.1;

b. 10 000 kg NEQ of HD 1.2;

c. 35 000 kg NEQ of HD 1.3.3;

d. 35 000 kg NEQ of HD 1.3.4; and

e. 20 000 kg NEQ of HD 1.4.

1.26 In addition two Explosive Workshops (traversed, with protective roofs) each with an explosives limit of 500 kg NEQ are required in the depot.

1.27 The specified task requirement is to design a depot using earth covered magazines or traversed light structures and to compare the two.

Introduction to Calculations

1.28 There is no correct solution to a problem of this type. There are many alternative solutions, all of which are satisfactory and the one adopted will depend on the circumstances pertaining at the time. In consequence of the example only indicates the principles which must be considered and draws attention to many of the factors which influence the selection of the final solution.

Considerations Related to the Choice of Number of Explosive Store Houses

1.29 The holdings of the depot are detailed in paragraph 25. The number of ESH required to hold these amounts of EO will depend on many factors including:

a. **Dispersion.** The degree to which operational staff wish stock to be dispersed within a depot in order to prevent the loss of the complete depot stocks of specific natures in the event of one ESH being destroyed.

b. **Types of ESH.** The size and type of ESH to be used will often depend on economical factors and the availability of standard approved designs if ESH.

c. **Terrain.** Suitability of the area allocated for the construction of various types of ESH and routes, rail etc.

Number of Explosive Store Houses in the example

1.30 For the purpose of the example only it is assumed that:

a. Stocks are to be dispersed in two ways within the depot.

b. Either standard igloos designed to 7 bar or standard traversed, light structures both of capacity 25 000 kg NEQ are to be used.

c. The terrain imposes no particular restriction on construction.

1.31 It follows that the stocks of individual hazard divisions must each be divided between at least two ESH as shown below:

a. HD 1.1–2 x ESH each containing 20 000 kg NEQ.

b. HD 1.2–2 x ESH each containing 5000 kg NEQ.

c. HD 1.3.3–2 x ESH each containing 17 500 kg NEQ.

d. HD 1.3.4–2 x ESH each containing 17 500 kg NEQ.

e. HD 1.4–2 x ESH each containing 10 000 kg NEQ.

1.32 For economy by keeping the number of ESH required to a minimum, it will be necessary to mix the HD within ESH. The mixing rules are given in Regulation 4.2. There are a number of different ways of mixing the stocks, but for the purpose of this example the following will be adopted:

a. ESH 1 and ESH 2. Each containing 20 000 kg NEQ of HD 1.1 and 5000 kg NEQ of HD 1.4. The effective NEQ of each ESH is 20 000 kg of HD 1.1 since the NEQ of HD 1.4 is ignored for QD calculations, (see Regulation 5.4 Annex A paragraph 1.65a.).

b. ESH 3 and ESH 4. Each containing 17 500 kg NEQ of HD 1.3.3 and 5000 kg NEQ of HD 1.2. The aggregate quantity for the EO as HD 1.2 and 1.3 must be calculated separately and the greater distance applied, (see Regulation 5.4 Annex A paragraph 1.65f.). The EO of HD 1.2 includes both HD 1.2.1 and HD 1.2.2 therefore the QD to be used is that for the full NEQ of the more hazardous type.

c. ESH 5 and ESH 6. Each containing 17 500 kg NEQ of HD 1.3.4.

Outer Quantity Distances

1.33 The results of these calculations for both types of structures (i.e. igloos and traversed light structures) are shown in tables 1–2 and 1–3 respectively.

ESH No. (Igloo)	NEQ kg/HD	Outer Quantity Distance to Exposed site (m)					
		IBD	Reference Column/ Row	PTRD (Heavy traffic on road therefore full IBD)	Reference Column/ Row	Railway (The railway can be easily stopped, therefore use 2/3 IBD)	Reference Column/ Row
1 and 2			Table 1A1-1		Table 1A1-1		Table 1A1-1
Face on	20 000/ 1.1	610	f/20	610	f/19 (D13)	405	f/19 (D11)
Rear on		610	a/20	610	a/19 (D13)	405	a/19 (D11)
Side on		610	b/20	610	b/19 (D13)	405	b/19 (D11)
3 and 4			Table 1A1-3		Table 1A1-3		Table 1A1-3
Face on	17 500/ 1.3.3	240	f/20	240	f/19 (D4)	160	f/19 (D3)
Rear on		170	a/20	170	a/19 (D4)	115	a/19 (D3)
Side on		170	b/20	170	b/19 (D4)	115	b/19 (D3)
3 and 4			Table 1A1-2		Table 1A1-2		Table 1A1-2
Face on	5 000/ 1.2	123	b/10	123	b/9 (D1)	83	b/9 (D5)
Rear on		No QD	a/10	No QD	a/10	No QD	a/10
Side on		No QD	a/10	No QD	b/10	No QD	a/10
5 and 6			Table 1A1-4		Table 1A1-4		Table 1A1-4
Face on	17 500/ 1.3.4	170	f/20	170	f/19	60	f/19
Rear on		170	a/20	170	a/19	60	a/19
Side on		170	b/20	170	b/19	60	b/19

Table 2–2: Outer Quantity Distances for Potential Explosion Site as an Igloo

ESH No. (Igloo)	NEQ kg/HD	Outer Quantity Distance to Exposed site (m)					
		IBD	Reference Column/ Row	PTRD (Heavy traffic on road therefore full IBD)	Reference Column/ Row	Railway (The railway can be easily stopped, therefore use 2/3 IBD)	Reference Column/ Row
1 and 2	20 000/ 1.1	610	Table 1A1-1 b/20	610	Table 1A1-1 b/19 (D13)	405	Table 1A1-1 b/19 (D11)
3 and 4	17 500/ 1.3.3	170	Table 1A1-3 b/20	170	Table 1A1-3 b/19 (D4)	115	Table 1A1-3 b/19 (D3)
	5 000/ 1.2	123	Table 1A1-2 b/10	123	Table 1A1-2 b/9 (D1)	83	Table 1A1-2 b/9 (D5)
5 and 6	17 500/ 1.3.4	170	Table 1A1-4 b/20	170	Table 1A1-4 b/19	60	Table 1A1-4 b/19

Table 3–3: Outer Quantity Distances for Potential Explosion Site as traversed light structure

1.34 A study of the table 1–2 shows that no major advantages accrue in terms of reduced exterior quantity distances from the use of igloos rather than traversed, light structures. Light structures may therefore, at first glance, appear attractive because of their reduced costs in construction, but inside quantity distances must always be considered before any decision is made and this topic is considered below.

Inside Quantity Distances

1.35 The inside quantity distances between magazines and process buildings need to be considered. These distances are designed to prevent propagation and to reduce damage to stocks and injuries to personnel working in such places in the event of an accidental explosion. It is rarely necessary to consider a process building as a PES, because the NEQ in a process building is normally so small that the quantity distance between a process building and an explosive storage building is determined by the contents of the storage building, when this is regarded as a PES. This is true in this example and in consequence no calculations for the process buildings have been done. The necessary distances are detailed in tables 1–4 and 1–5.

ESH No. (Igloo)	**NEQ kg/HD**	**Inside Quantity Distance to Exposed site (m)**				
		Reference Table/Column	Other ESH	Reference Table/Row	Railway	Reference Table/ Row
1 and 2	20 000/ 1.1	Table 1A1-1/f	22 (virtual complete protection)	Table 1A1-1/1	220	Table 1A1-1/16
3 and 4	17 500/ 1.3.3	Table 1A1-3/f	25 (high/limited degree of protection)	Table 1A1-3/1	84	Table 1A1-3/16
	5 000/ 1.2	Table 1A1-2/b	No QD	Table 1A1-2/1	45	Table 1A1-2/6
5 and 6	17 500/ 1.3.4	Table 1A1-4/f	2	Table 1A1-4	25	Table 1A1-4/16

Table 4–4: Inside Quantity Distances for Potential Explosion Site as an Igloo

ESH No. (Igloo)	**NEQ kg/HD**	**Outer Quantity Distance to Exposed site (m)**				
		Reference Table/Column	Other ESH	Reference Table/Row	Railway	Reference Table/ Row
1 and 2	20 000/ 1.1	Table 1A1-1/d	66 (high degree of protection)	Table 1A1-1/14	220 (note fragment hazard)	Table 1A1-1/16
3 and 4	17 500/ 1.3.3	Table 1A1-3/d	30	Table 1A1-3/14	84	Table 1A1-3/16
	5 000/ 1.2	Table 1A1-2/b	26/83	Table 1A1-2/5	45	Table 1A1-2/6
5 and 6	17 500/ 1.3.4	Table 1A1-4/d	60	Table 1A1-4 e/14	25	Table 1A1-4e/19

Table 5–5: Inside Quantity Distances for Potential Explosion Site as traversed light structure

1.36 The inside quantity-are, in the case of igloos, dependent on the relative orientation of the igloo as a PES to the igloo as an ES. For example in table 1–1 an igloo as a PES with the door facing (column f) requires:

a. D12—distances ($22.2Q^{1/3}$) to a door of an igloo (7 bar) as an ES for virtually complete protection (row 7);

b. D5—distances ($1.1Q^{1/3}$) to the side of an igloo (7 bar) as an ES for virtually complete protection, if primary explosives are excluded (row 4); and

c. D4—distances ($0.86Q^{1/3}$) to the rear of an igloo (7 bar) as an ES for virtually complete protection, if primary explosives are excluded (row2).

1.37 It follows that in order to obtain full advantage from the use of igloos in terms of reduced areas of real estate required for a depot, igloos must never be sited so that they have doors facing each other. For the purposes of this example, therefore, it is assumed that igloos will be sited with doors facing the rear of adjacent igloos.

1.38 A study of tables 1–4 and 1–5 reveals the advantages of using igloos. For example in the case of ESH 1 and 2 containing 20,000 kg NEQ of Hazard Division 1.1 only 22 m separation from other igloos in required for virtually complete protection for stocks in ES, whilst in the case of traversed, light structures a separation of 66 m is required for lass protection of stocks. It is this reduced separation with increased protection which is the main attraction of using igloos. The economics will have to be calculated for each individual site as the additional cost of construction of igloos must be balanced against the reduced length of routes, perimeter fences and other utilities.

Conclusion

1.39 The tables give in broad terms the applicable Outside and Inside Quantity Distances for both igloos and light structures. The decision on which type of structure to use depends on many factors beyond the scope of this example, such as detailed study of the land, availability of material and labour, and perhaps, above all, the economics of the alternatives.

APPLICATION OF INTER-MAGAZINE DISTANCES FOR EXPLOSIVE ORDNANCE OF HAZARD DIVISION 1.1

Introduction

1.40 In applying the Inter-Magazine Distances (IMD) given in Regulation 5.4 Annex A Appendix 1 Table 1A1-1, of this procedure, consideration must be given to the type of construction at both the PES and the ES, and to the orientation of the sites to each other.

1.41 The following conditions apply when determining the proper separation distances between Earth-Covered Buildings (ECB) of Type (3) and Igloos of Type (4) building design type - see Regulation 6.1 Procedure 1 paragraphs 1.8 and 1.9 which, by the nature of their construction, induce marked directional effects on blast and projections.

General

1.42 When Type (3) ECBs and (4) Igloos containing HD 1.1 EO are sited so that any one is in the forward sector 60° either side of the centre line of another (in front of), the two must be separated by a distance greater than the minimum permitted for side-to-side orientation. The greater distances are required primarily for the protection of door and headwall structures against blast from a PES forward of the ES and, to a lesser extent, to the directionality of effects from the source.

1.43 When a blast wave is reflected from a surface at other than grazing incidence (side-on orientation), the overpressure may be increased substantially over the free-field value. High reflected pressure and impulse can damage doors and headwalls and propel the debris into the ES so that explosion is communicated by impact of such debris upon the contents.

1.44 The permitting of some significant (but oblique) untraversed headwall-to-headwall exposure at a reduced (less than full front-on) IMD, constitutes a relaxation of conditions that have been proved safe by test. Some examples of the application of these rules follow.

Application of Quantity Distances to Type (3) Earth-Covered Buildings and Type (4) Igloos

1.45 ECB and igloos sited so that the headwalls of both buildings A and B (see Figure 1-3) are outside the 120° sector (60° either side of the centre-line), may be separated by the applicable side-to-side distance given in Regulation 5.4 Annex A Appendix 1 Table 1A1-1, based upon the largest NEQ of HD 1.1 stored in either building.

1.46 If the headwall of building A (see Figure 1-4) is outside of the 120° sector of building B, but the headwall of B is inside the 120° sector of A, the separation distance between these two ECB is determined using side-to-face distances based on the largest quantity of HD 1.1 in either building.

1.47 If the headwalls of buildings A and B (see Figure 1-5) are within the 120° sector of each other and are not provided with a separate door barricade or traverse, normal face-to-face distances must be used to separate them.

1.48 Although no separate traverse is shown between buildings A and B in Figure 1-5, more detailed analysis of a specific storage condition of this type might show that the distribution of EO within A and B is such that the earth fill of one or the other or both meets the specifications of an effective traverse in accordance with Regulation 6.1 Procedure 2 paragraphs 2.15-19 inclusive. In such a case, D7-distances would apply between A and B.

Other Earth-Covered Building Orientations

1.49 Two additional Type (3) ECB and (4) Igloo orientations warrant analysis. These are:

a. Buildings A and B are either of significantly different length (see Figure 1-C-6) or 'canted' in such a manner (see Figure 1-C-7) that one of them is within the 120° sector of the headwall of the other, even though a straight line between headwall A and building B does pass through the earth cover of B.

b. If building B is the PES and A is the ES in Figures 1-C-6 and 1-C-7, the explosive limit for B would be determined by regarding A as being 'face-on' to the side of B, i.e. use side-to-face distances. With A as the PES however, the limit for A would be determined by regarding A and B as being either front-to side or front-to-rear. Building B could be used to its physical capacity for HDs other than HD 1.1.

Quantity Distance Relationships between Earth-Covered Buildings and Other Aboveground Explosive Ordnance Facilities

1.50 When considering QD relationships between ECB and other aboveground EO storage, or EO facilities requiring PBD each containing HD 1.1 EO, the question regarding the use of traversed or untraversed distances arises. The following criteria apply:

a. Aboveground EO storage or facilities requiring Process Building Distances (PBD), that are within the 120° sector of the front of an ECB, are to be provided untraversed distances unless a separate effective intervening traverse is present, in which case traversed distances are to be applied, i.e. the 'face-on'-to- ES distances of Regulation 5.4 Annex A Appendix 1 Table 1A1-1, are to apply.

b. Aboveground EO storage or facilities requiring PBD, that are outside the 120° sector of the front of an ECB are to be provided with traversed distances whether or not a separate intervening traverse is present, i.e. the 'side-on - to -ES distances of Regulation 5.4 Annex A Appendix 1 Table 1A1-1, are to apply.

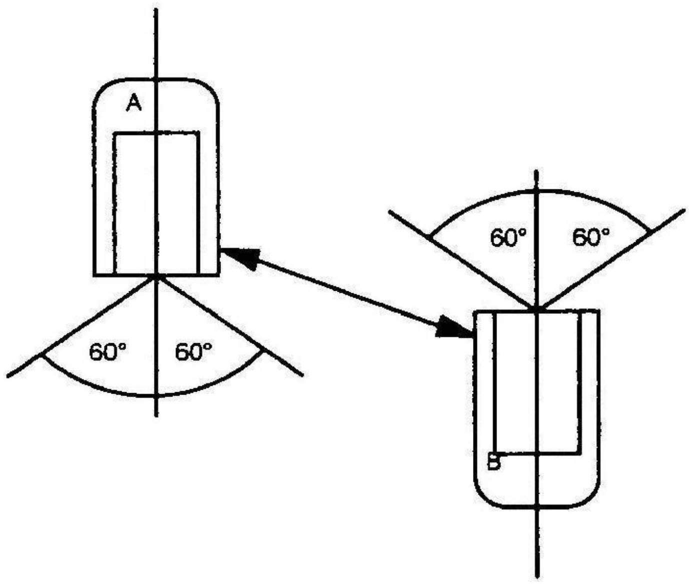


Figure 1–3: Earth – Covered Building Orientation

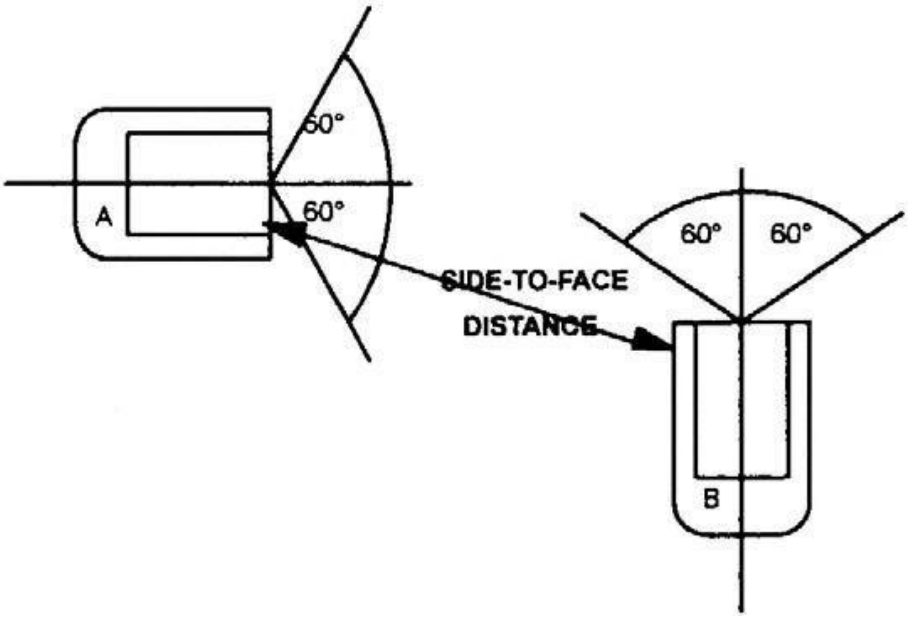


Figure 1–4: Earth – Covered Building Orientation

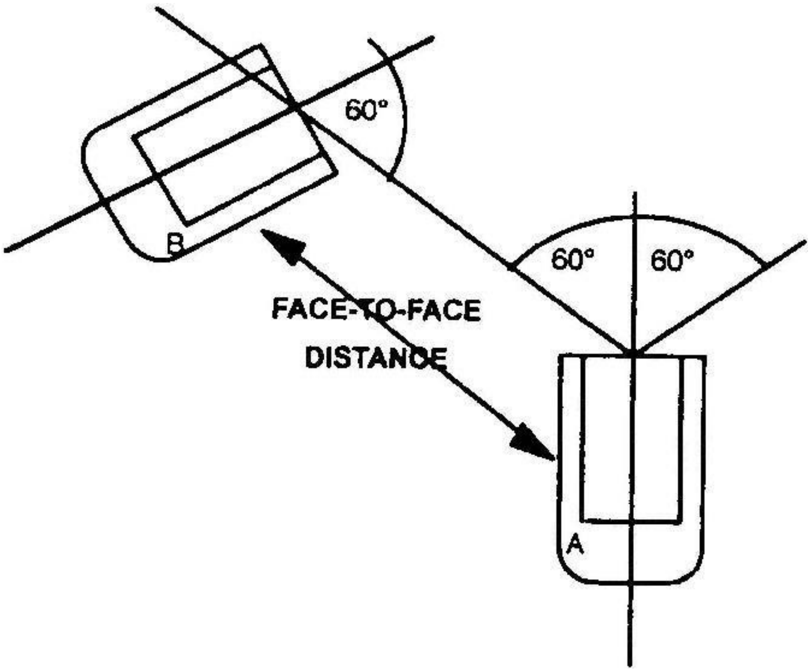


Figure 1–5: Other Earth – Covered Building Orientation

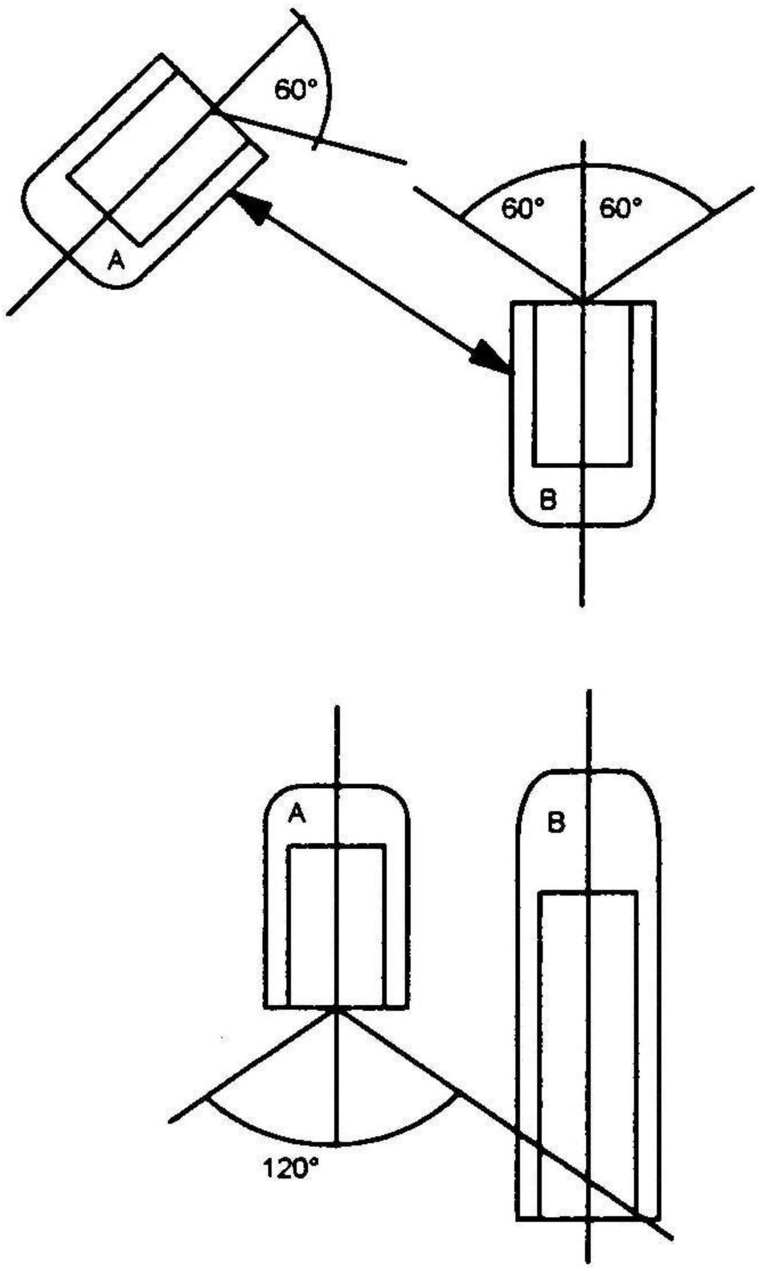


Figure 1–6: Other Earth – Covered Building Orientation

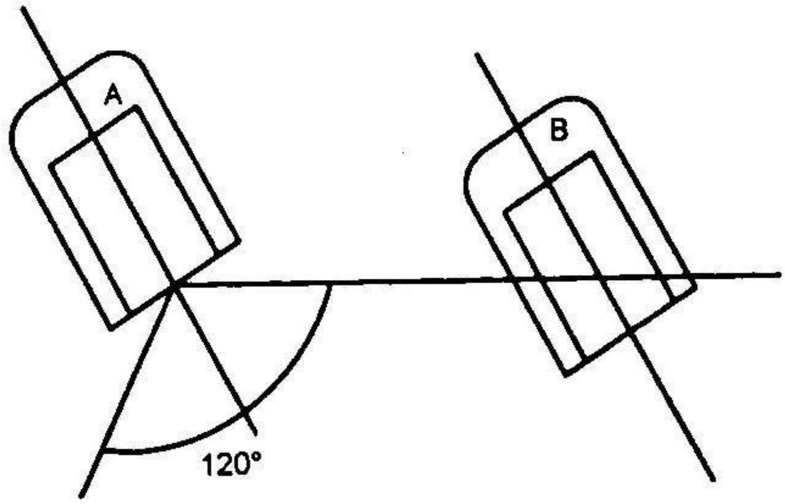


Figure 1–7: Other Earth – Covered Building Orientation

REGULATION 5.5 - BURNING AND DEMOLITION GROUNDS

General Overview

5.1 Burning and demolition grounds are areas specifically designated for controlled disposal of Explosive Ordnance (EO) and are to be licensed for this purpose. The certainty of fire and explosion at burning and demolition grounds necessitates the imposition of safety distances which provide for levels of protection greater than that specified for normal storage and handling activities.

Requirements

5.2 Burning and Demolition Grounds are to be sited, established and licensed in accordance this regulation and its associated procedure.

Siting of Burning and Demolition Grounds.

5.3 A board of officers is to be convened for the siting of demolition and burning grounds. The board of officers is to consider the following:

a. Safety distances both horizontal and vertical;

b. Terrain;

c. Vegetation and its control;

d. Environmental protection and bio-diversity conservation;

e. Firing Points and Operator Bays;

f. Firefighting;

g. Communications;

h. Fencing; and

i. Signs and posters.

Burning and demolition grounds are to be of sufficient area to contain the hazard envelopes within Defence owned or controlled property.

Licensing of Burning and Demolition Grounds

5.4 All Burning and Demolition grounds are to be licensed.

Responsibilities

5.5 Officers-in-Charge (OIC) are responsible for controlling burning and demolition grounds at their establishments have prime responsibility and duty of care to ensure that EO disposal activities are conducted safely.

5.6 Defence Infrastructure Division is responsible for convening boards of officers for the siting of burning and demolition grounds.

5.7 The LA is responsible for the licensing of burning and demolition grounds.

Procedures

5.8 The procedure used to implement the requirements of this regulation is Procedure 1 – Siting, Establishing and Licensing of Burning and Demolition Grounds.

PROCEDURE 1 - SITING, ESTABLISHING AND LICENSING OF BURNING AND DEMOLITION GROUNDS

Introduction

1.1 Occasions will arise when Explosive Ordnance (EO) that for the purposes of this procedure include non-explosive dangerous goods, must be destroyed as the only suitable means of disposal. Depending on the type of EO, this may be done in a furnace or by burning at a burning ground or by demolition at a demolition ground by exploding an adjacent charge.

1.2 A burning ground is an area specifically set aside for disposal of EO by burning only. Some explosives and items of EO may be disposed of by burning with no risk of a mass detonation occurring, although some explosions will probably occur. Other items of EO can only be disposed of by demolition. A demolition ground is an area specifically set aside for disposal of EO by demolition. This means of disposal is mainly applicable when the EO is damaged or otherwise non-repairable and breakdown is either hazardous or uneconomical. With this method of disposal, mass detonations are likely.

1.3 A burning ground or demolition ground is not to be confused with a ‘demolition range’ that is an area used for the primary purpose of conducting demolition and operational Explosive Ordnance Disposal training. Typically, these activities include training for the destruction of infrastructure such as bridges, roads, electricity pylons and the like, conducted by Army RAE (Royal Australian Engineers) and RAINF (Royal Australian Infantry). The co-location of burning and demolition grounds with demolition ranges is commonplace but the reverse does not apply.

1.4 The quantities of EO burned or demolished at any one time and the conditions under which the burning or demolition takes place must be strictly controlled to ensure that there is no hazard to personnel or property. Accordingly, all burning and demolition grounds must be licensed before use.

Purpose

1.5 This procedure specifies the requirements for the siting, establishing and licensing of burning and demolition grounds.

Responsibilities

1.6 When a new burning or demolition ground is to be sited, a Board of Officers is to be convened for this purpose by the Defence Estate Organisation, in accordance with the requirements of Regulation 5.1 Procedure 1.

1.7 Before being taken into use all Defence burning and demolition grounds are to be licensed by the Licensing Authority in accordance with the requirements of Regulation 5.2 Procedure 1.

SITING AND ESTABLISHMENT CRITERIA

General

1.8 Officers-in-Charge (OIC) responsible for controlling burning and demolition grounds at their establishments have prime responsibility and duty of care to ensure that EO disposal activities are conducted in safety. In these circumstances, safety extends not only to ensuring the protection of the disposal operators, whose safety should be assured by strict supervision and the use of controlled and proven procedures, but also to all other Defence personnel and facilities and to personnel and property outside the Defence facility.

1.9 Unless otherwise approved by the Licensing Authority, protection of all personnel and property is to be provided by safety distances that will provide protection from explosive blast, fragmentation, seismic and thermal effects. Such safety distances should not be confused with Quantity Distances used in EO storage.

1.10 All burning and demolition grounds are to be sited so that the effects of noise, smoke and vibration on other Defence facilities and activities, and local residents are as low as reasonably practicable. The area at risk from blast or fragment damage is intended to be contained within the perimeter of the burning or demolition ground.

Safety Distances Requirements – Horizontal and Vertical

1.11 The certainty of fire and explosions occurring during the destruction of EO necessitates the imposition of levels of protection (safety distances) greater than those specified for normal storage and handling activities (quantity distances). General guidance for calculating the applicable safety distances for EO destruction activities is provided in annexes A and B.

1.12 Within the destruction area, the required safety distance will depend on the type and quantity of EO being destroyed, the method of destruction and the degree of protection provided for the personnel conducting the destruction. Firing points and sentry posts within the destruction area should be protected by solid brick, concrete or steel walls or sand filled boxes or bags, and have overhead cover.

Site Selection

1.13 **Terrain.** The terrain chosen for the destruction site should be sufficiently open to permit easy control and monitoring of access, ie there should be as few routes as possible by which personnel not concerned with the destruction can approach the danger area without being detected. To facilitate clearance at the completion of the destruction, the ground should be free of deep fissures in which unburnt explosives could accumulate. There should be no blind gullies or other enclosed spaces from which escape may be difficult in the event of it being necessary to evacuate the site quickly.

1.14 **Vegetation.** There should be no dense shrubs and trees in the destruction area and none at all close to the actual destruction point. The destruction point should also be clear of grass and all other grass kept sufficiently short to reduce the fire hazard.

1.15 **Environmental Considerations.** Proposals and activities at burning or demolition grounds must comply with Defence policy and procedures on environment protection and bio-diversity conservation. In general an environmental impact assessment or EIA will be required for proposals involving new sites. Specific details pertaining to the consideration of environmental impacts can be found in the Defence Estate Quality Management System, Environment and Resource Management page. If the proposed location has the potential to impact on a matter of environmental significance, referral under the EPBC Act (1999) may be required. For consideration of the non-significant impacts on the environment an Environmental Clearance Certificate (ECC) will be required.

1.16 Environmental approval must be obtained in addition to a disposal licence before conducting any disposal activities. This approval (ECC, Environmental Management Plan (EMP) etc) is separate to the licence and provides a simple and rapid clearance method for proposed Defence actions such as those of a burning or demolition ground. The responsible Regional Environmental Officer can provide advice. Particular attention is normally paid to the effects on the environment from:

a. The products of combustion,

b. The effects of noise or shock,

c. The dispersal of toxic or hazardous gases and residue, and

d. The effects of residue.

1.17 **Burning Grounds.** In the selection of burning grounds, areas without ground cover with a hard flat surface, free from rocks and debris, should be chosen. Trees and shrubs should be cleared to at least 30 meters from the site. The burning ground should not be sited below steep cliffs, as these may modify air currents causing acceleration in the burning rate with the possible consequence of an explosion that could spread debris over a wide area. The burning ground is to be of sufficient area to:

a. Contain, within Defence owned or controlled land, the required safety distances in annex A; and

b. Where specifically constructed hearths or ovens are not being used, allow the EO, or other dangerous goods being burnt, to be laid on different ground for each successive open burn on any one day.

1.18 **Demolition Grounds.** The area chosen to be used for surface or below surface demolition of EO, should be level with deep soil relatively free from rocks, stones, undergrowth and trees. These conditions reduce the fire and fragmentation hazards arising from an explosion and enable the easy digging of postholes and undercuts in which to set up demolitions. If below surface demolitions are necessary, the use of sandy soil is to be avoided due to difficulty in digging undercuts. Demolition grounds should be contained within Defence owned or controlled land, the required safety distances in annex B, and be sited, where possible, on high ground to limit blast reflection effects

NOTE

A demolition ground may also be required to contain a burning ground (or vice versa). Consequently, the selection criteria for each ground should not be considered in isolation.

Firing Point and Operator Bays

1.19 A permanent firing point should be provided from which the destruction is initiated. It must provide adequate personnel protection from the worst explosive event possible during the authorised destructions. Armoured glass observation windows or a periscope should be provided to permit a final check of the destruction site prior to firing. Bunkers or shelters must also be provided for other personnel situated within the hazard envelope.

Firefighting

1.20 First attack firefighting equipment must be available at the destruction site.

Communications

1.21 Adequate communications inside and outside the destruction area are essential. Ideally, the firing point should be provided with a telephone with access to the establishment exchange, the fire section and any remote sentry position. Hand held radio communications may be used, provided that provision is made for applying electro-explosive hazard precautions.

Livestock

1.22 Livestock is permitted to graze burning or demolition grounds provided that allowance is made for clearing of the animals from the near vicinity when the grounds are in use.

Fencing

1.23 Burning and demolition grounds are to be enclosed by security fencing as indicated in electronic Defence Security Manual (eDSM), in accordance with the following:

a. The security fence should follow the boundary of the burning or demolition ground as far as practicable. When the situation dictates that this is not possible (eg terrain unsuitable for fencing or perimeter roads enable security patrols), the area boundary is to be delineated by fencing of at least stock type construction.

b. In cases where the security fencing cannot follow the demolition ground boundary, the fence is to be sited not nearer than the minimum unprotected safety distance applicable to the most hazardous nature likely to be disposed of in that area. Areas suitable for future expansion of the demolition ground should be considered for inclusion in the fenced area. In the case of burning grounds, the proximity of the fence will depend on the facilities present, and the natures and quantities intended for destruction (eg the use of a SAA burning oven, types/quantities of propellant), but in all cases is to be sited no closer than 100 m.

c. Fire breaks are to be established to enable surveillance. Trees and other vegetation are to be cleared in accordance with requirement of the Manual of Fire Protection Engineering (MFPE), on the Defence side of the fence.

d. Where the EO area for the establishment and the burning or demolition ground are adjacent, the common dividing fence may be of the stock type provided that external access to all areas is constrained by approved security fencing.

Signposting

1.24 Demolition grounds are to have the following signs and posters displayed:

a. ‘Prohibited Area’ signs (at 50 m intervals along the boundary fence);

b. ‘Prohibited Article’ signs (at all entrances to the ground);

c. ‘Controlled Article’ signs (at all entrances to the ground);

d. ‘No Smoking’ signs (at all entrances to the ground);

e. ‘Warning-Unexploded Ordnance’ signs (at 50 m intervals along the boundary fence); and

f. ‘Contaminated Ground’ signs (to be posted in areas that have been contaminated by chemicals or WP)

NOTE

All signs that are made up locally are to have red lettering on a white background.

LICENSING

General

1.25 Burning and demolition grounds are areas specifically designated for controlled disposal of EO and are to be licensed for this purpose. To conduct any disposal operations requiring a licence, a valid Environmental approval (ECC, EMP etc) must be obtained. The certainty of fire and explosion at burning and demolition grounds necessitates the imposition of safety distances (see paragraphs 1.11 and 1.12) which provide for levels of protection greater than that specified for normal storage and handling activities.

1.26 Burning and demolition grounds are only to be licensed if they are of sufficient area to contain the hazard envelopes within Defence owned or controlled property or on property leased by Defence specifically for such destruction activities.

Explosives Limit Licence

1.27 All burning and demolition grounds are to be licensed by the Licensing Authority using an Explosives Disposal Area Licence (Form EO 004). A specimen of the Form EO 004 and applicable licensing procedures are available in Regulation 5.2 Procedure 1.

1.28 The licence is to include and specify the following as a minimum:

a. The disposal procedures approved for use, eg surface burning, furnaces, destructors, below ground demolitions, and any operational restrictions;

b. The maximum allowable net explosives quantity (NEQ) for each authorised disposal procedure and Hazard Division;

c. Any restrictions applicable to other classes of dangerous goods; and man and equipment limits and/or other restrictions; and

d. The requirement for a valid ECC or EMP.

Licensing Criteria

1.29 When in use, burning and demolition grounds are Potential Explosion Sites but are not normally to be considered as Exposed Sites when determining QD requirements.

1.30 In raising the licence for a disposal area the Exposed Sites within the destruction area to be considered are:

a. EO storage buildings for items about to be destroyed or used in destruction; and

b. Operator's bays, including the firing point.

1.31 **Safety Distance Requirements.** For applicable safety distances see paragraphs 1.11 and 1.12.

Annexes:
A. Calculation of Hazard Safety Distance Envelopes - Disposal of EO by Burning
B. Calculation of Hazard Safety Distance Envelopes - Disposal of EO by Demolition (Including Disposal by Burning that may lead to a Mass Explosion or Produce a Projection Hazard)

ANNEX A

CALCULATION OF HAZARD SAFETY DISTANCE ENVELOPES - DISPOSAL OF EO BY BURNING

1. Dangerous Goods Class 1 explosives are unique in that their Hazard Division (HD) are liable to change with alterations in packaging or configuration. For example, EO normally classified as HD 1.1, i.e. a substance or article that has a mass explosion hazard, may produce only a radiant heat hazard when subjected to particular disposal by burning procedures. Consequently the following safety criteria and safety distances are to apply:

a. **Burning operations that CANNOT lead to a mass explosion or produce a projection hazard.** Personnel and private property are not to be exposed to a heat radiation intensity exceeding 1.6 kW/m^2. For propellants and less energetically burning items, the appropriate safety distance is 100 m with a licensed NEQ not to exceed 500 kg.

b. **Disposal by burning of explosive substances (but not articles) that can detonate, but long experience or extensive trials, have shown can be burned without explosion.** Many explosive and pyrotechnic substances may be safely burnt without explosion provided certain conditions are met, ie burning in thin layers, lack of containment, the wetting of pyrotechnic compositions with oil. When these types of operations are conducted:

(1) Personnel are to be protected by a distance of 100 m.

(2) Buildings and other exposed sites external to the burning ground are to be protected by a distance derived from the formula:

$D = 22.2Q^{1/3}$, with a minimum distance of 400 m being applied to Group IV facilities.

(3) The license maximum for burning is not to exceed 100 kg NEQ.

c. Disposal by burning of small arms ammunition and HD 1.4 in approved ovens and pits:

(1) A minimum safety distance of 100 m is to apply, and

(2) The maximum NEQ for disposal by this method is 100 kg.

ANNEX B

CALCULATION OF HAZARD SAFETY DISTANCE ENVELOPES - DISPOSAL OF EO BY DEMOLITION (INCLUDING DISPOSAL BY BURNING THAT MAY LEAD TO A MASS EXPLOSION OR PRODUCE A PROJECTION HAZARD)

General

1. Demolition grounds are to contain all predictable fragments and projections, blast overpressures over 0.2 kPa ($D = 140Q^{1/3}$ or window and dish rattle threshold) and, for buried explosions, seismic vibrations with a peak particle velocity greater than 7 mm/s. Structures of national or heritage importance are not to be subject to seismic vibrations greater than 2 mm/s.

Horizontal Safety Distances

2. Where the hazard envelope prescribed by the country-of-origin/manufacturer for an item(s) to be disposed of is known (or should be known), the prescribed safety distances are to be applied. If the hazard envelope is not known, the following formulae are to be applied to determine the required horizontal safety distance (the largest distance calculated is to be applied):

a. Blast Safety Distance:

$D = 140Q^{1/3}$ (or $Q = (D/140)^3$)

Where D is the safety distance in m and Q is the TNT equivalent in kg of the explosives being destroyed. In all situations, a 50 m minimum safety distance is to apply.

b. Fragmentation Safety Distance:

(1) Single item or encased bulk explosive:

$D = 370W^{1/5}$ (or $W = (D/370)^5$)

Where D is the safety distance in m and W is the total mass in kg of the item being disposed of plus the mass of the demolition charge.

Note

W is not to exceed 67 kg. Where W exceeds 67 kg, the applicable safety distance is to be calculated in accordance with the Automated Explosive Ordnance Disposal System (AEDPS) (TM-60 Series) 60A 1-1-4 and DEOP 116 Part 1 Section 2 Chapter 1.

(2) Stacked or multiple munitions:

$D = 650W^{1/5}$ (or $W = (D/650)^5$)

Where D is the safety distance in m and W is the mass in kg of the largest item in the stack.

Note

W is not to exceed 67 kg. Where W exceeds 67 kg, the applicable safety distance is to be calculated in accordance with the Automated Explosive Ordnance Disposal System (AEDPS) (TM-60 Series) 60A 1-1-4 and DEOP 116 Part 1 Section 2 Chapter 1.

c. **Thermal Radiation Safety Distance.** This is under review. However, safety distances for thermal effects will not exceed those required for blast or fragmentation effects.

d. **Seismic Effects Safety Distances.** Procedures to assess ground vibration limits and maximum permitted levels for ground vibration (peak particle velocities) are as specified and recommended in Appendix J to Australian Standard (AS) 2187.2-1993- *Explosives-Storage Transport and Use* Part 2: *Use of Explosives*.

NOTE

No other part of Australian Standard (AS) 2187.2-1993-*Explosives-Storage Transport and Use* Part 2: *Use of Explosives* is to be applied to Defence activities.

Vertical Safety Distances

3. Where trials data is not available, vertical safety distances are to be calculated as follows:

a. Vertical Safety Distance (Fragmentation) (VSD(F)):

(1) VSD(F) single item = $314W^{1/5}$ (units m and kg) where W is the total mass (item plus charge) of the item; and

(2) VSD(F) stacked items = $470W^{1/5}$ (units m and kg) where W is the total mass (item plus charge) of the largest single item in the stack;

b. Vertical Safety Distance (Blast) (VSD(B)):

(1) VSD(B) no buffeting to aircraft = $140Q^{1/3}$ (units m and kg); and

(2) VSD(B) buffeting tolerable = $112Q^{1/3}$ (units m and kg)

where Q is the TNT equivalent of the total mass of explosive in the stack.

c. **Application of Procedures.** Both VSD(F) and VSD(B) are to be calculated and the larger distance selected. These formulas are governed by the Australian Ordnance Council (AOC) Proceeding 205.92 '*Control of Airspace Above Explosives Facilities and Sites of Planned Demolitions*' dated 14 July 1992. The distance selected is to be converted to feet, site above ground level (AGL) added if required for Notice to Airman (NOTAM), then be rounded up to the next 100 ft and add 500 ft for safety. VSD(B) tolerable distances are only to be used when approved by the appropriate aviation authority.

REGULATION 5.6 - SAFEGUARDING AND ZONE PLANNING

General

6.1 Explosive Ordnance (EO) storage and handling facilities attract a high level of investment. Therefore, it is important to protect the long-term viability of these facilities from the adverse effects of incompatible developments. This is achieved through processes known as safeguarding and zone planning.

Requirements

6.2 This regulation prescribes the provisions for safeguarding of, and zone planning for, EO facilities.

6.3 Safeguarding and Zone Planning is to be conducted in accordance with this regulation and its associated procedures.

SAFEGUARDING AND ZONE PLANNING

Safeguarding Policy

6.4 It is Defence policy to protect the utility of a licensed Potential Explosion Site (PES) from the adverse effects of development outside Defence-controlled property. This will occur when the effects of the licence extend beyond the departmental property boundary and adequate control cannot be exercised over development within the affected non-Defence property. The process used to provide the required protection is known as safeguarding.

6.5 Safeguarding is, in the first place, a consultative process intended to ensure that those Local Planning Authorities (LPA) and landowners affected by an explosives licence are aware of Defence's need to protect the utility of that licensed facility. Thus, whenever an explosives licence in any way affects property not under Defence control, LPA and landowners whose interests are affected are to be advised of the nature of the effect. Whenever advising another party of safeguarding matters care is to be taken that the information is accurate and of a format and content which, as far as possible, ensures that the advice is properly understood. If a person takes action to their detriment on the basis of incorrect or misleading statements, the Commonwealth may be liable to compensate persons affected.

6.6 **Safeguarding Lines and Zones.** The safeguarding lines and zones used within Defence are:

a. **Green Line/Zone.** The green line is the envelope of the lines drawn at the PTR for each PES in the facility. The green zone is the area within this line.

b. **Yellow Line/Zone.** The yellow line is the envelope of the lines drawn at the Inhabited Building Distance (IBD) for each PES in the facility. The yellow zone is the area within this line.

c. **Purple Line/Zone.** The purple line is the envelope of the lines drawn at twice the IBD for each PES in the facility licensed for explosives of Hazard Division 1.1. The purple zone is the area within this line.

6.7 **Safeguarding Criteria.** The main safeguarding principle is to protect the utility ie facility, its contents and adjoining areas and is subject to the required Quantity Distances (QD), see Regulation 5.4. Criteria to be considered when safeguarding EO facilities are as follows;

a. **Control of Developments.** Defence must be able to exercise sufficient control of the surrounding land to control developments. The means that Defence may be required to own, lease, rent or borrow facilities/property.

b. **Vertical Safeguarding.** Airspace restrictions are required above some EO facilities to protect their utility.

6.8 **Safeguarding Maps.** Safeguarding maps are maps which depict the safeguarding lines and zones for establishments which have licensed EO facilities. Safeguarding maps are to be prepared for all Defence owned, leased, rented or borrowed facilities licensed to hold, or those being planned to hold EO. All LPA controlling non-departmental property affected by safeguarding are to be provided with sufficient copies of safeguarding maps for their purpose.

6.9 **Public Information Brochure.** In addition to producing safeguarding maps, the Department is to produce a public information brochure, Defence Reference Book (DRB) 42—Safeguarding maps for explosives facilities, to explain the concept of safeguarding to members of the public. All LPA controlling non-departmental property affected by safeguarding are to be provided with sufficient copies of DRB 42 for their purpose.

Zone Planning

6.10 The utility of an existing or planned EO facility may also be adversely affected by certain developments internal to the Department's property boundary. This possible interaction is to be taken into account by preparing Defence Establishment Zone Plans which are to display all areas set aside for future developments including EO facilities. Adequate provision is to be made for safeguarding zones likely to result from the facilities when constructed. Head of Estate and Infrastructure Group (E&IG) is the Defence authority for zone planning.

Coordination of Safeguarding and Zone Planning

6.11 E&IG is responsible for departmental safeguarding and master planning. Accordingly, HI is to coordinate Defence safeguarding and zone planning requirements. Where elements of Defence share or have adjacent facilities, HI is to nominate a particular appointment to be responsible for coordinating the safeguarding and master planning for the facilities involved. The appointment is to maintain a record of all deviations, safeguarding and master planning information relating to these facilities, and is to ensure that the activities in any facility are compatible with the activities of adjacent facilities. In the event that conflicts of interest cannot be resolved locally, the matter is to be referred for resolution to the appropriate Service or departmental authority, who may in turn refer the matter to HI for decision. Where other EO related facilities are adjacent to Defence facilities, HI is to ensure that safeguarding and master planning arrangements are appropriately coordinated.

PROTECTIVE AND SAFEGUARDING MEASURES FOR EO FACILITIES

Protective Measures

6.12 To ensure that risks to EO facilities are reduced as far as practicable, and in addition to the safeguarding concepts detailed above, EO facilities require the following protection from:

a. Fire;

b. Explosion or Blast;

c. Lightning;

d. Sea/Air Attack;

e. Ground Attack; and

f. Theft and Sabotage.

Responsibilities

6.13 The Licensing Authority is to:

a. Determine for each EO facility whether a Safeguarding Map is required;

b. Determine the Green Line, Yellow Line and Purple Line distance for each PES where a Safeguarding Map is required; and

c. Provide safeguarding line data to Head Infrastructure (HI).

6.14 E&IG is the Defence authority on safeguarding and is responsible for ensuring that:

a. Up-to-date copies of safeguarding maps and DRB 42 are distributed as required to regional E&IG offices;

b. LPA are aware of the Department's intentions with respect to safeguarding zones; and

c. Safeguarding maps are maintained under constant review, and in any case that a review is undertaken on at least a two yearly basis.

6.15 HI is to:

a. Arrange for the preparation of classified safeguarding maps for internal and departmental use;

b. Arrange for the preparation of unclassified public issue safeguarding maps displaying, as appropriate, those safeguarding lines that extend beyond the defence property boundary; PES and the nature of EO stored therein are not to be shown;

c. Ensure that all unclassified public issue safeguarding maps are annotated as follows:

'A Department of Defence public information brochure entitled Defence Reference Book 42 - Safeguarding Maps for Explosives Facilities, to explain the use of Safeguarding Maps is available from the Officer-in-Charge of this Defence establishment';

d. Authorise and distribute completed classified safeguarding maps to the Licensing Authority and the units/establishments to which the maps refer;

e. Authorise and distribute completed unclassified public issue safeguarding maps to the regional E&IG representatives who are to provide them to the affected LPA and property owners and ensure that the LPA and property owners:

(1) Are requested to recognise the Defence's interests within identified safeguarding zones, and

(2) Notified of Defence's intention to appeal against incompatible development applications involving identified safeguarding zones; and

f. Ensure safeguarding maps are maintained under constant review, and in any case that a formal review is undertaken on at least a two yearly basis.

g. Ensure that master planning arrangements are appropriately coordinated.

Procedures

6.16 Procedures used to implement the requirements of this regulation are:

a. Procedure 1 – Safeguarding and Zone Planning

b. Procedure 2 – Protective and Safeguarding Concepts for Explosive Ordnance and associated Storage and Handling Facilities

PROCEDURE 1 - SAFEGUARDING AND ZONE PLANNING

Introduction

1.1 Storage and handling facilities for Defence Explosive Ordnance (EO) are essential to the conduct of Defence Force Operations. These facilities are expensive to construct and maintain and because of the inherent risks involved in handling and storing EO, their use is governed by stringent safety regulations. Public or internal developments such as the construction of inhabited buildings or roads in close proximity to EO facilities may impose severe restrictions on the operation of these facilities. Therefore, it is important to protect the long-term viability of Defence EO facilities from any adverse effects of incompatible developments. This is achieved through processes known as Safeguarding and Zone Planning.

1.2 Public development has, in the past, resulted in Defence being unable to maintain appropriate Quantity Distances (QD) around EO facilities. In order that State and Local planning authorities are made aware of the impact of their development plans on the operation of Defence EO facilities, it is necessary to establish procedures for consultation. The first stage in the establishment of such procedures is the production of safeguarding maps for EO facilities that show the areas in which the Department aims to oppose certain types of development. These maps when issued to planning authorities will form part of the consultative process.

1.3 Safeguarding provisions are designed to protect the utility of a licensed Potential Explosion Site (PES) from the adverse effects of development outside Defence controlled property while master planning controls the possibility of certain internal developments having an adverse effect on the utility of a PES.

Purpose

1.4 This procedure prescribes Safeguarding and Zone Planning Provisions for EO Facilities.

SAFEGUARDING

Safeguarding policy

1.5 It is Defence policy to safeguard the utility of a licensed PES from the adverse effects of development outside Defence-controlled property. This will occur when the effects of the licence extend beyond the departmental property boundary and adequate control cannot be exercised over development within the affected non-Defence property.

1.6 Safeguarding is, in the first place, a consultative process intended to ensure that those Local Planning Authorities (LPA) and landowners affected by an EO licence are aware of Defence's need to protect the utility of that licensed facility. Thus, whenever an EO licence in any way affects property not under Defence control, LPA and landowners whose interests are affected are to be advised of the nature of the effect. Whenever advising another party of safeguarding matters care is to be taken that the information is accurate and of a format and content which, as far as possible, ensures that the advice is properly understood. If a person takes action to their detriment on the basis of incorrect or misleading statements, the Commonwealth may be liable to compensate persons affected.

Safeguarding lines

1.7 Because the process of safeguarding involves the consideration of Exposed Sites (ES)[1] which do not exist (but might exist in the future if sufficient control is not exercised) the term QD cannot be used in this context. The term Safeguarding Lines are used. Safeguarding Lines are drawn at distances that coincide with those of QD for Public Traffic Routes (PTR), Inhabited Buildings, and Large Facilities. The Safeguarding Lines used within Defence are:

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1 QD exists only between a PES and ES. It does not exist in abstract around a PES, ie an ES must be present for QD to exist.

a. **Green line.** The Green Line is the envelope of the lines drawn at the PTR for each PES in the facility.

b. **Yellow line.** The Yellow Line is the envelope of the lines drawn at the Inhabited Building Distance (IBD) for each PES in the facility.

c. **Purple line.** The Purple Line is the envelope of the lines drawn at twice[2] the IBD for each PES in the facility licensed for EO of Hazard Division (HD) 1.1.

Safeguarding map

1.8 A Safeguarding Map is an unclassified map depicting the Safeguarding Lines for facilities that are licensed for EO activities.

SAFEGUARDING CRITERIA

Control over land adjoining departmental facilities

1.9 The essence of safeguarding lies in the exercise of sufficient control over development in those parts of safeguarding envelopes that extend beyond defence owned or controlled land. The existence of a Safeguarding envelope beyond the Defence property boundary implies that the Department intends to oppose development proposals of certain types of public structures and facilities in the envelope. Clearly, if the Purple envelope is contained within Defence owned or controlled land, sufficient control is, in principle, established, although where such land is owned by the Commonwealth but not controlled by Defence, appropriate coordination with the controlling Department or authority must be maintained. Thus, Defence authorities should aim to contain all Purple envelopes within Defence owned or controlled land. In some instances, this will not be practicable, and safeguarding envelopes will extend beyond the Defence property boundary. In some cases, sufficient control may be clearly established without ownership, eg certain Crown lands, State forests, open seas or non-navigable rivers.

1.10 Where the Yellow envelope is contained within Defence owned or controlled land but the Purple envelope extends beyond, sufficient control must be established over the development of Group V structures and facilities (See Regulation 5.4 Procedure 1). Where the Green envelope is contained within Defence owned or controlled land but the Yellow envelope extends beyond, sufficient control must be established over the development of structures and facilities of Group IV and Group V within the Yellow envelope. Where the Green envelope extends beyond Defence owned or controlled land, sufficient control must be established over the development of structures and facilities of Group III, Group IV and Group V within the Green envelope.

1.11 It should be noted that if Safeguarding envelopes extend into private property it is not normally possible to control development of structures and facilities. Such envelopes are therefore not properly safeguarded and must be regarded as liable to public encroachment at short notice.

1.12 Under the circumstances where Safeguarding envelopes extend beyond Defence property boundaries and sufficient control cannot clearly be established, advice is to be furnished to Head Estate and Infrastructure Group (E&IG, information copy to the Licensing Authority. Head E&IG will then investigate the situation and initiate any necessary further action.

1.13 There is not normally a requirement to safeguard temporary PES established for exercise or other approved non-permanent activities. However, the likely duration of the requirement should be taken into account when considering safeguarding. Landowners affected in any way by an activity must be notified as appropriate.

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[2] For a PES where high risk testing is conducted, the distance used to determine the Purple Line is 2.5 times the IBD.

Safeguarding of leased, rented or borrowed facilities.

1.14 It is not practical for the Department to safeguard leased, rented or borrowed facilities. However, the Department needs to be aware of the property developments beyond the boundary of such facilities that may affect EO activities. Accordingly, the Departmental Licensing Authority is to maintain maps showing appropriate safeguarding zones.

Vertical safeguarding

1.15 Air space restrictions are required above some EO facilities to protect their utility. It is the responsibility of establishment commanding officers (CO)/officers commanding (OC)/directors to determine whether vertical safeguarding is required and whether this should be a temporary or permanent restriction.

1.16 HI is to negotiate permanent restrictions with Air Services Australia (ASA) and is to advise the location coordinates of all affected facilities. Notification of temporary restrictions to ASA is the responsibility of establishment CO/OC/directors.

1.17 **EO facilities.** Flights over EO facilities should be restricted to those that are considered to be essential transit only. When flights are essential they are to comply with the normal minimum heights applicable to the surrounding area, ie 1000 ft (305 m) for urban areas and 500 ft (153 m) for rural areas. Should flights be required below these minimum heights, the circumstances are to be referred to Head E&IG on a case by case basis. Head E&IG will seek advice from the Directorate of Ordnance Safety as necessary.

1.18 **Demolition and burning grounds.** The minimum height for flights over planned detonations is to be calculated by the Licensing Authority and recorded on the Demolition or Burning Ground Licence as the Vertical Danger Space Minimum (see Regulation 5.5 Procedure 1). Where the Vertical Danger Space Minimum exceeds the figures at paragraph 1.17 the Officer-in-Charge of the unit/establishment is responsible for notifying Air Services Australia (ASA).

1.19 **Airfields.** At airfields, permanent and long-term EO facilities other than Aircraft Safety Points, Explosive Ordnance Loading Aprons and Air Movements Explosive Ordnance Aprons should not be sited within the approach or departure funnels for fixed or rotary wing aircraft. Explosive Ordnance Loading Aprons and Air Movements Explosive Ordnance Aprons should be sited outside the funnels if practicable and operationally acceptable.

Explosive ordnance facilities for which safeguarding maps are required

1.20 Safeguarding Maps are to be prepared for all Defence owned, leased, rented or borrowed facilities licensed to hold (see Regulation 5.2 Procedure 1), or those being planned to hold, EO (except as provided for in paragraph 1.21), where safeguarding envelopes for these current or planned facilities extend beyond Defence owned or controlled land. Internal safeguarding maps are to be prepared for all EO facilities, except those listed at paragraph 1.22.

1.21 Projected facilities which are at a sufficiently advanced stage of planning as to be in a works program, or are identifiable as a future PES, are to be taken into account in identifying areas to be safeguarded.

Explosive ordnance facilities for which safeguarding maps are not required

1.22 Safeguarding maps are not required for:

a. Small Quantity Facilities (SQF) storing EO under special conditions of storage (see Regulation 4.4 Procedure 13). Any changes to facilities or new developments occurring adjacent to SQFs, a review of the EO risk hazard assessment previously conducted must be carried out;

b. Demolition or burning grounds or proof yards;

c. Firing ranges; and

d. Aircraft safety points.

However, for completeness it is E&IG policy to produce Safeguarding Plans for all units and the Plans show the location of all EO facilities including SQF.

Public information brochure

1.23 In addition to producing safeguarding maps, the Department has produced a public information brochure, Defence Reference Book (DRB) 42—Safeguarding maps for explosives facilities, to explain the concept of safeguarding to members of the public.

Computation of safeguarding distances

1.24 Defence service personnel married quarters are to be considered as Group IV risk, and administration buildings as Group III risk depending on the relationship of the administration function to overall area function and the numbers of people employed therein (See Regulation 5.4 Procedure 1).

1.25 Detailed instructions on the computation of safeguarding distances are given at Annex A.

PROCEDURES FOR THE PREPARATION AND DISTRIBUTION OF SAFEGUARDING MAPS

1.26 Procedures for the preparation and distribution of Safeguarding Maps are detailed below.

1.27 The Licensing Authority is to:

a. Determine for each EO facility whether a Safeguarding Map is required;

b. Determine the Green Line, Yellow Line and Purple Line distance for each PES where a Safeguarding Map is required; and

c. Provide safeguarding line data to Head E&IG.

1.28 Head E&IG is to:

a. Arrange for the preparation of classified safeguarding maps for internal and departmental use;

b. Arrange for the preparation of unclassified public issue safeguarding maps displaying, as appropriate, those safeguarding lines that extend beyond the defence property boundary; PES and the nature of EO stored therein are not to be shown;

c. Ensure that all unclassified public issue safeguarding maps are annotated as follows:

‘A Department of Defence public information brochure entitled Defence Reference Book 42 - Safeguarding Maps for Explosives Facilities, to explain the use of Safeguarding Maps is available from the Officer-in-Charge of this Defence establishment’;

d. Authorise and distribute completed classified safeguarding maps to the Licensing Authority and the units/establishments to which the maps refer;

e. Authorise and distribute completed unclassified public issue safeguarding maps to the regional E&IG representatives who are to provide them to the affected LPA and property owners and ensure that the LPA and property owners:

(1) Are requested to recognise the Defence’s interests within identified safeguarding zones, and

(2) Notified of Defence’s intention to appeal against incompatible development applications involving identified safeguarding zones; and

f. Ensure safeguarding maps are maintained under constant review, and in any case that a formal review is undertaken on at least a two yearly basis.

ZONE PLANNING

1.29 The utility of an existing or planned EO facility may also be adversely affected by certain developments internal to Defence’s property boundary. This possible interaction is to be taken into account by preparing Defence Establishment Zone Plans which are to display all areas set aside for future developments including EO facilities. Adequate provision is to be made for safeguarding envelopes likely to result from the facilities when constructed. Zone Plans must not be confused with plans/maps/sketches for ‘existing conditions’ which are intended to display all currently licensed facilities and their attendant safeguarding envelopes, and water, electrical and other services. Such plans are required also for efficient management and control particularly during emergencies, and are dealt with elsewhere in this manual.

COORDINATION OF SAFEGUARDING AND ZONE PLANNING

1.30 **General.** E&IG is responsible for departmental safeguarding and zone planning. Accordingly, Head E&IG is to coordinate Defence safeguarding and zone planning requirements. Where elements of Defence share or have adjacent facilities, Head E&IG is to nominate a particular appointment to be responsible for coordinating the safeguarding and zone planning for the facilities involved. The appointment is to maintain a record of all deviation, safeguarding and zone planning information relating to those facilities, and is to ensure that the activities in any facility are compatible with the activities of adjacent facilities. In the event that conflicts of interest cannot be resolved locally, the matter is to be referred for resolution to the appropriate Service or departmental authority, which may in turn refer the matter to Head E&IG for decision. Where other EO related facilities are adjacent to Defence facilities, Head E&IG is to ensure that safeguarding and zone planning activities are appropriately coordinated.

1.31 **Responsibilities.** Head E&IG is the defence authority for zone planning and is to ensure that all zone planning arrangements are appropriately coordinated.

Annex:
A. Computation of safeguarding distances

ANNEX A

COMPUTATION OF SAFEGUARDING DISTANCES

1. **Calculating Distances.** After determining those PES within a facility which must be safeguarded, it is necessary to determine the Green, Yellow and Purple Line safeguarding distances applicable to each of those PES. To calculate the distances, it is necessary to construct a safeguarding matrix. The first step involves listing the licensed limits for the PES (or the proposed limits for a future PES), in a tabular form. An example of this tabulation is given at paragraph 8.

2. **Calculation of Green Line.** The calculation of the green (minor PTRD) lines for each HD is as follows:

   a. **HD 1.1.** Derived from the maximum NEQ permitted for the PES at the D11 distance from Table 1 of Regulation 5.4 Procedure 1, Annex A, or a 270 m minima, whichever is the greater.

   b. **HD 1.2/1.2.1.** Derived from the maximum NEQ permitted for the PES at the D2 distance from Table 2 of Regulation 5.4 Procedure 1, Annex A. However, should it be justified, the minor PTRD of 135 m may be used.

   c. **HD 1.2.2.** Derived from the maximum NEQ permitted for the PES at the D1 distance from Table 2 of Regulation 5.4 Procedure 1, Annex A. However, should it be justified, the minor PTRD of 90 m may be used.

   d. **HD 1.3/1.3.3.** Derived from the maximum NEQ permitted for the PES at the D4 distance from Table 3A of Regulation 5.4 Procedure 1, Annex A.

   e. **HD 1.3.4.** Derived from the maximum NEQ permitted for the PES at the D4 distance from Table 3B of Regulation 5.4 Procedure 1, Annex A. However, should it be justified, the minor PTRD of 60 m may be used.

NOTE

The use of a minimum of 180 m in regard to the 1 800 kg reduced quantity rule is not considered for the calculation of Green Line distances due to the special nature of the rule and to maintain storage optimisation of affected PES.

3. **Calculation of Yellow Line.** The calculation of the yellow (IBD) lines for each HD is as follows:

   a. **HD 1.1.** Derived from the maximum NEQ permitted for the PES at the D13 distance from Table 1 of Regulation 5.4 Procedure 1, Annex A, or a 400 m minima, whichever is the greater.

   b. **HD 1.2/1.2.1.** Derived from the maximum NEQ permitted for the PES at the D2 distance from Table 2 of Regulation 5.4 Procedure 1, Annex A.

   c. **HD 1.2.2.** Derived from the maximum NEQ permitted for the PES at the D1 distance from Table 2 of Regulation 5.4 Procedure 1, Annex A.

   d. **HD 1.3/1.3.3.** Derived from the maximum NEQ permitted for the PES at the D4 distance from Table 3A of Regulation 5.4 Procedure 1, Annex A.

   e. **HD 1.3.4.** Derived from the maximum NEQ permitted for the PES at the D4 distance from Table 3B of Regulation 5.4 Procedure 1, Annex A.

NOTE

The use of a minimum of 270 m in regard to the 1 800 kg reduced quantity rule is not considered for the calculation of Yellow Line distances due to the special nature of the rule and to maintain storage optimisation of affected PES.

4. **Calculation of Purple Lines.** The purple line is twice the IBD as determined by the HD 1.1 licence in accordance with Regulation 5.4 Procedure 1, Annex A, Table 1, D13 distances multiplied by a factor of 2 (or 2.5 as applicable), or over riding minima (see paragraph 5).

5. **Over–Riding Minima.** Where the QD tables specify the requirement for an over–riding minima, the safeguarding distance to be applied is the D13 distance, or that minima, whichever is the largest. For example, in the case of an untraversed PES licensed to store 3 000 kg HD 1.1, the QD tables call for an IBD of D13>400 m. Therefore, the Yellow Safeguarding distance of 305 m and the specified minima of 400 m. In the case of Purple Safeguarding distances, the over–riding minima are not doubled, but they still apply (in effect, the formula for such distances becomes 2D13>400 metres). Therefore, for the same example PES, the Purple Safeguarding distance to be applied is 610 m – twice 305 m, as opposed to 800 m (twice the over–riding minima). This in effect indicates that the D13>400 distance is adequate for the purple line until the 2D13 distance is greater than 2D13>400. Therefore, a PES licence limit of 1 600 kg is the first indicator that the purple line will exceed 400 m.

6. **Safeguarding Lines for HD 1.4.** Safeguarding lines do not apply to HD 1.4.

7. **Complete Safeguarding Lines.** The complete lines are direct from the largest distance within each colour as shown in the following example.

PROCEDURE FOR DEVELOPING A SAFEGUARDING MATRIX FOR A PES

8. **Step 1.** Draw a safeguarding matrix as shown below and show the licensed limits for the PES in question.

HD	NEQ (kg)	Green	Yellow	Purple
1.1 1.2/1.2.1 1.2.2 1.3/1.3.3 1.3.4	1 600 18 000 70 000 200 000 200 000			

9. **Step 2.** The next step is to determine the green lines for each HD. In this example, the HD 1.1 limit is 1 600 kg which attracts a D11 distance of 140 m, therefore, the 270 m minima is to apply. In all other cases, the HD 1.2/1.3 criteria from paragraph 2 apply as follows:

a. HD 1.2 - 400 m (or 135 m minor PTRD).

b. HD 1.2.2 - 400 m (or 90 m minor PTRD).

c. HD 1.3 - 375 m

d. HD 1.3.4 - 375 m (or 60 m minor PTRD)

10. **Step 3.** The next step is to determine the yellow lines for each HD. In this example, the HD 1.1 limit of 1 600kg attracts a D13 distance of 210 m, therefore the 400 m minima is to apply. In all other cases, the HD 1.2/1.3 criteria from paragraph 3 apply as follows:

a. HD 1.2 - 400 m

b. HD 1.2.2 - 400 m

c. HD 1.3 - 375 m

d. HD 1.3.4 - 375 m

11. **Step 4.** The next step is to determine the purple line distance. In this example, the purple line distance will be 420 m, not 800 m (twice the IBD of 400 m), as explained at paragraphs 4 and 5.

12. **Step 5.** The safeguarding matrix can then be completed as shown below. The largest distance in each column is used to draw the relevant safeguarding line:

HD	**NEQ (kg)**	**Green**	**Yellow**	**Purple**
1.1 1.2/1.2.1 1.2.2 1.3/1.3.3 1.3.4	1 600 18 000 70 000 200 000 200 000	270 400 (or 135 m) 400 (or 90 m) 375 375	400 400 400 375 375	420 - - - -
Applicable Safeguarding Distance (m)		400	400	420

13. A matrix displaying the methodology for the computation of safeguarding distances is as follows:

HD	**NEQ (kg)**	**Green**	**Yellow**	**Purple**
1.1 1.2/1.2.1 1.2.2 1.3/1.3.3 1.3.4	Qty Qty Qty Qty Qty	D11>270 m D2 (or 135 m) D1 (or 90 m) D4 D4 (or 60 m)	D13>400 m D2 D1 D4 D4	2D13>400 or 2.5D13>400 N/A N/A N/A N/A
Applicable Safeguarding Distance (m)		The largest distance from each column applies		

PROCEDURE 2 - PROTECTIVE AND SAFEGUARDING CONCEPTS FOR EXPLOSIVE ORDNANCE AND ASSOCIATED STORAGE AND HANDLING FACILITIES

Introduction

2.1 Explosive Ordnance (EO) in storage and handling facilities imposes a potential risk to both individuals and property. In order to minimise these risks in the event of an accidental explosion, it is necessary to site such facilities at prescribed quantity distances from buildings, roads, railways or other places frequented by public or service personnel. Measures are also necessary to protect EO and associated facilities from fire, lightning, theft, sabotage, air or ground attack.

2.2 A measure known as safeguarding which is a consultative process between local planning authorities and Defence, aims to protect the effectiveness and capacity of EO facilities from the effects of civil encroachment by public or private development within the prescribed Outside Quantity Distances.

2.3 Collectively the processes identified at paragraphs 2.1 and 2.2 seek to control the inherent risks attached to EO, the possibility of misuse of EO or its unwanted destruction and at the same time preserving the effectiveness and capacities of Defence EO facilities from circumstances that are outside of the direct control of Defence.

Purpose

2.4 This procedure introduces the protective and safeguarding concepts to be applied to Defence EO and associated permanent storage and handling facilities. Some of these concepts do not apply to the storage of EO under Field Storage conditions during military operations.

PROTECTIVE MEASURES

2.5 The following provisions are required against the risk of fire, explosion or blast, including the risk of such hazards as lightning, attacks from the sea, air or ground, theft and sabotage.

Fire Safety

2.6 The term 'fire safety' is a generic term used by Defence to cover three interrelated matters, namely: fire protection, fire prevention and firefighting. Comprehensive fire safety arrangements are to be planned and implemented at all EO establishments. Since fire safety arrangements are an integral part of physical security whenever fire safety arrangements are planned they should be coordinated with physical security arrangements to maximise the security and safety of Defence assets and personnel.

2.7 Regulation 4.7 Procedure 1 prescribes the requirements for fire protection, fire prevention and firefighting in EO areas and associated facilities.

2.8 For information, the Defence Chief Fire Safety Officer (CFSO) is responsible for:

a. Determining policy concerning fire protection levels;

b. Providing advice on the requirements for fixed fire protection systems and the maintenance of firefighting equipment;

c. Engineering aspects of fixed fire protection systems and their maintenance; and

d. Monitoring fire systems design and installation standards;

Queries by establishments on any of the above aspects should be made, in the first instance, to the Regional Fire Safety Officer of the Estate and Infrastructure Group (E&IG).

Explosion or Blast

2.9 Propagation of an explosive event is caused mainly by high velocity fragments and it is impracticable to prescribe adequate Inside Quantity Distances that will prevent propagation and, at the same time, keep storage areas to a reasonable size. Therefore, traverses are to be provided to contain the effects of direct fragmentation and they may be of some value in deflecting blast. See Regulation 6.1 Procedures 1 and 2, Regulation 5.4, and Regulation 2.2 Procedure 1.

Lightning Protection

2.10 All EO facilities other than those exceptions given in Regulation 6.2 Procedure 1 paragraph 5 are to be provided with lightning protection to the requirements of Regulation 6.2 Procedure 1. In addition, all non EO buildings, poles, and other structures within EO areas, are to be protected also in accordance with the specified requirements.

Sea/Air Attack

2.11 The possibility of attack from the sea or air is always to be considered when siting EO storage facilities. The destruction of the contents of one or more storage facilities may not be very serious where re-supply is readily obtainable, but at remote and overseas units where supplies cannot be readily replaced, hardened storage facilities may be required. At all user establishments, dispersal of each type of store between two or more buildings is to be considered so that destruction of the contents of one building will not involve the loss of the total stocks of any particular item. At Main EO Depots dispersal of stocks between two buildings is to be regarded as the absolute minimum acceptable and wider dispersal should be the aim (see Regulation 4.1 Procedure 1). These measures offer protection of stocks in the event of the contents of one storehouse being destroyed for any reason.

Ground Attack

2.12 Because of their nature, certain types of EO are susceptible to small arms fire, eg thin-walled HE and phosphorus smoke stores. The vulnerability of such stores must be considered when selecting appropriate storage facilities. Traversed storage should be utilised if their loss, or effects on destruction, are unacceptable.

Theft and Sabotage

2.13 To assist in preventing loss by theft or sabotage, it is necessary to enclose all EO buildings, or the area containing them within a security fence constructed in accordance with AS 1725 and Base Security Operations Manager (BSOM). The fence should be easy to patrol and it is to be sited at a minimum distance of 50m from any building containing EO, except that where it does not form the outer boundary of the establishment the distance may be reduced to 10m.

2.14 In areas where ground defence requirements are paramount, or where local circumstances are such that an undue extension of the area to be defended and patrolled cannot be tolerated, establishments are to report the facts to the appropriate RSO for advice.

2.15 All EO buildings are to be constructed using recognised construction techniques of passive resistance to forced entry. In addition, doors, windows and the interiors of certain buildings are to be fitted with approved security devices. Consideration must be given also to the provision of approved intruder detection systems in EO buildings. Approved security devices and systems are listed in the Security Equipment Catalogue (SEC) however, advice should be sought from the appropriate BSOM before any device or system is selected for installation.

2.16 All keyboards for EO facilities are to be secured when not in use or are to be kept under constant surveillance.

2.17 Gates to EO areas are to be locked when not in actual use; sentries are to be posted when the gates are not secured and cannot be kept under constant surveillance.

2.18 Security requirements are detailed in electronic Defence Security Principles Framework (DSPF).

SAFEGUARDING - PROTECTION AGAINST CIVIL ENCROACHMENT

General

2.19 It is Defence policy to protect the operations of EO facilities from encroachment by external development through the exercise of sufficient control over the development of land outside Commonwealth property boundaries and airspace above EO areas. This process, known as Safeguarding, is to be observed for all Defence EO facilities.

2.20 Safeguarding policies and procedures are detailed in Regulation 5.6 Procedure 1.

REGULATION 6.1 - EXPLOSIVE ORDNANCE BUILDINGS AND THEIR CONSTRUCTION

General Overview

1.1 Explosive Ordnance (EO) buildings, including any surrounding traverses are designed to protect the contents of the building or other adjacent buildings or other assets in event of an incident or accidental explosion. Therefore careful consideration must be given to the end use of the storage building which influences the design type and construction of building or magazine.

Requirements

1.2 EO facilities are to be designed and constructed in accordance with the requirements of this regulation.

EXPLOSIVE ORDNANCE BUILDINGS

Types of Explosive Ordnance Buildings

1.3 There are five main types of EO building designs. The building design selected for use should be of one of the following types:

a. Type 1 - Light Frangible Structure[1];

b. Type 2 - Heavy-Walled Building with/without Protective Roof;

c. Type 3 - Earth Covered Building;

d. Type 4 – Igloo[2]; or

e. Type 5 - Process Building.

General Design and Constructional Requirements

1.4 The following general design and constructional elements require consideration when designing and constructing an EO building:

a. The size of the building;

b. Items to be stored within;

c. Pressure Release;

d. Protection against Projections;

e. Flammable Materials;

f. Lightning Protection – see Regulation 6.2;

g. Bonding of Metal;

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[1] Procedures in Procedure 1 separates Type 1 buildings into two categories, Light Frangible Structure and Medium Walled Buildings. The Medium Walled Building is considered a Light Structure when determining QD until this building category included in the QD tables in Regulation 5.4.

[2] Design requirements for Igloos are found in AASTP-1 - Manual of NATO Safety Principles for the Storage of Military Ammunition and Explosives, Edition 1, Change 3 dated May 2010. NB. The continued use of AASTP 1: 2010 is under review

h. Earthing Requirements;

i. Floors;

j. Doors;

k. Windows;

l. Ventilation;

m. Air-Conditioning;

n. Heating;

o. Cooling;

p. Decoration;

q. Lead-Free Requirement; and

r. Lifting Appliances.

TRAVERSES

Purpose of Traverses.

1.5 An effective traverse will achieve the following functions:

a. Interception of high velocity projections;

b. Protection from lobbed EO and fragments; and

c. Modification of blast and flame.

Classification of Traverse types

1.6 Traverses are classified into four functional types according to the nature of the protection they give. The types of traverses are as follows:

a. Receptor Traverse;

b. Interceptor Traverse;

c. Container Traverse; and

d. Screening Traverse.

Traverses Design Criteria

1.7 The following design criterion requires consideration and assessment when planning construction of a traverse:

a. Traverse Type;

b. Traverse Geometry;

c. Positioning;

d. Earth Type Materials;

e. Other Traverse Materials;

f. Erosion of Traverse Materials;

g. External and Internal Walls; and

h. Air Blast Affects on Personnel behind a Traverse.

CALCULATION OF STORAGE CAPACITY AND SPACE REQUIREMENTS

Considerations

1.8 The effective capacity is normally to be assessed as half the floor area of the storage facility multiplied by the height of the stacks. Alternatively, accurate calculations may be undertaken if the types of stores and their packaging arrangements are known.

1.9 Although the effective capacity of a storage facility is the factor most likely to limit the amount of EO that can be accommodated, it is also governed by the hazard division and the net explosives quantity of the items to be stored in the facility, the available quantity-distance and whether or not the facility is traversed.

Calculations

1.10 Calculations can be conducted by either:

a. Storage capacity of and existing facility, or

b. The floor area which will be occupied by a given quantity of packages.

Responsibilities

1.11 All personnel involved with the planning, design, and acceptance of EO storage areas and/or EO facilities are to ensure compliance with these regulations and their associated procedures.

Procedures

1.12 Procedures used to implement the requirements of this regulation are:

a. Procedure 1 - Principles for Design and Construction

b. Procedure 2 – Traverses

c. Procedure 3 – Calculation of Storage Capacity and Space Requirements

Guidance

1.13 Further information on the design environment can be found in Pamphlet 8 – Design Environment located in the Guidance Section associated to the Department of Defence Explosive Regulations on the DOS website.

PROCEDURE 1 - PRINCIPLES FOR DESIGN AND CONSTRUCTION

INTRODUCTION

Purpose

1.1 This instruction primarily gives guidance on the safety features required in the design and construction of Explosive Ordnance (EO) storehouses and process buildings so that:

a. At an Exposed Site (ES), initiation of, and/or damage to the contents of an EO building can be prevented by structural resistance to blast and high velocity projections;

b. At a Potential Explosion Site (PES), initiation of, and damage to the contents of adjacent buildings can be prevented by intercepting high velocity projections and reducing blast; and

c. In process buildings personnel can be protected from the effects of a nearby explosion.

1.2 Design and construction requirements common to most EO buildings together with construction requirements for special purpose buildings, are also described in this instruction. This instruction should be read in conjunction with Regulation 5.4 where the Quantity Distances (QD) required for the relevant buildings and traverse combinations are given. The construction aspects required for security purposes are set out in the Defence Security Principles Framework (DSPF).

1.3 Agencies responsible for the detailed design of EO facilities and traverses are to be conversant with the contents of Ministry of Defence (UK) Publication JSP 482 MOD Explosives Regulations, Chapter 6 and 7 – *Buildings and Traverses for Military Explosives*, US Forces Unified Facilities Criteria (UFC) UFC 3-340-02 – *Structures to Resist the Effects of Accidental Explosions*, and Regulation 6.1 Procedure 2 - Traverses.

EXPLOSIVE ORDNANCE BUILDINGS

1.4 There are five main types of EO building design. These different types of design used in EO facilities are introduced at paragraphs 1.5 to 1.10. The types described are those used in the QD tables in Regulation 5.4.

1.5 **Type 1 - Light Frangible Structure.** The major features of a light frangible structure are as follows:

a. A light frangible structure is built of light and frangible materials that will not produce dangerous projections at a PES. At an ES this structure could collapse but any debris produced would not initiate EO or do serious harm to personnel within. This type of structure provides little resistance to high velocity projections at an ES or PES and should be traversed to reduce Inside QD.

b. This type of structure is typically a single story steel framed building clad with lightweight steel, aluminium, Glass Reinforced Polyester (GRP) sheeting or similar.

c. A light structure gives less protection than other storehouse types from projections of HD 1.2 or from the fire risks of HD 1.3 EO.

d. Traversed light frangible structures are recommended for use in EO processing areas to minimise the amount of harmful debris that may be produced when explosives accidents occur.

1.6 **Type 1 (see sub-para e) - Medium Walled Building.** The major features of a medium walled building are as follows:

a. A medium walled building is one constructed of a nominal thickness of 215 mm solid or 280 mm cavity masonry walls or 150 mm Reinforced Concrete (RC) and a 150 mm thick RC roof slab.

b. At an ES this type of building could collapse and damage stocks as it is not normally designed to resist blast loads. The debris produced would depend on the quantity of explosives at the PES, and could have a high enough velocity to initiate explosives or seriously injure personnel within. This type of building would not resist the penetration of high velocity fragments at an ES (incoming) or PES (outgoing) and should be traversed to reduce Inside QD.

c. A medium walled building at an ES with a minimum 150 mm thick RC roof is reasonably effective in resisting fragments and lobbed EO from HD 1.2 EO and also provides adequate protection against the fire hazard from HD 1.3 EO.

d. The use of a special ‘screening’ traverse can reduce the Inhabited Building Distances from a PES of light/medium walled construction. This traverse must be high enough to intercept all missiles projected at 40° or less.

e. A medium walled building is to be considered a Light Structure when determining QD until this building category is included in the QD tables in Regulation 5.4.

1.7 Type 2 - Heavy-Walled Building With/Without Protective Roof. The major features of a heavy walled building are as follows:

a. A heavy walled building has walls of 680 mm thick brick or 450 mm thick RC and a protective roof with a minimum thickness of 150 mm RC.

b. At an ES this type of building will prevent initiation of EO inside it by resisting high velocity projections but it could collapse and damage stocks as it is not normally designed to resist blast. A receptor traverse is not usually required with this building type as the heavy walls fulfil this function, however if the stocks are vulnerable to attack by heavy spalling a separate traverse should be provided. Where the building’s door is exposed to fragments from a PES it should be shielded by a traverse.

c. At a PES this type of building may trap some or all of the high velocity projections, however the amount of debris is increased by the nature of its construction. The preferred minimum Inhabited Building Distance (IBD) is 400 m for EO of HD 1.1 in order to protect against the projection/debris threat.

d. A heavy-walled building is effective in stopping incoming fragments and lobbed EO of HD 1.2 where a protective roof is provided. It also gives good protection against the fire hazard from HD 1.3 EO.

1.8 Type 3 - Earth Covered Building. The major features of an earth-covered building are as follows:

a. An earth-covered building includes any structure (excluding igloos which are a special type of earth-covered building described below) which has a minimum of 600 mm of earth on the roof, with walls backed with earth (earth includes any acceptable organic fill material). The slope of the earth is dependent on the type of material used.

b. This type of structure behaves similarly to a heavy-walled building at an ES for all hazard divisions. A traverse is required to shield the door, or any weak wall not earth covered and which face a PES.

c. At a PES, an earth-covered building will trap most high velocity projections and reduce the blast effects in the near field (viz less than D9 QD for HD 1.1). The amount of debris is substantial and a long IBD is required. In theory it is possible that this distance could be reduced if the building were a light frangible structure and its earth-cover conformed to earth traversing specifications. In practice, a light frangible structure would be unlikely to support the earth cover and also satisfactory debris tests would be necessary before a reduced distance could be accepted.

1.9 **Type 4 - Igloo.** The major features of an igloo are as follows:

a. An igloo is an EO storehouse with earth cover as for an earth-covered building. The igloo is designed specifically to resist blast and high velocity projections so that the contents will not be initiated or seriously damaged at the required QD. It is generally constructed of corrugated steel and/or reinforced concrete covered with a minimum thickness of 600 mm of earth on the roof and earth cover on both sides and rear walls.

b. At an ES or PES it has the properties of an earth covered building with the added advantage of giving stocks virtually complete protection from initiation. The doors and headwall do not require a traverse provided they have been designed to resist the blast loading and high velocity projections.

c. The disadvantage of an igloo magazine is the relatively large IBD it requires. However, because of the reduced Inter-Magazine Distances, an EO storage area for igloos can be very compact. Significant site economy can be obtained when compared to the land required for other types of above ground magazines and open stacks.

1.10 **Type 5 - Process Building.** The major features of a process building are as follows:

a. In general, a process building is one in which EO is worked upon or manufactured and includes facilities like EO laboratories, missile test rooms, preparation rooms and workshops. At a PES, the building must be classified according to the construction in a similar way to the magazine types listed above before the appropriate QD can be determined. The total amount of EO is normally used to determine QD. In some cases this can be split up into smaller amounts and spaced or protected so that immediate propagation from one amount to the next cannot occur and so produce a progressive enhancement of the explosion effect. The smaller quantity can then be used for QD purposes. One way of achieving this is to divide up the process building into separate explosives compartments surrounded by suitable internal traverses. Provided the amount of explosives is small enough, adequate container traverses can be designed to trap most high velocity projections. It is possible to provide combined building and traverse that will deflect the blast upwards and trap projections of 0°-70° trajectory for quantities of up to 500 kg. Suppressive shielding can also be used to reduce both blast and projections. However, this is expensive and is not generally used.

b. At an ES, a process building requires relatively large QD to provide personnel protection rather than to prevent explosive initiation. The QD Tables permit reductions in process building distances for small quantities of EO (up to 4 000 kg NEQ in the PES) but the number of personnel intended to be employed in the ES should be carefully considered before using these reductions. Normally, this number has been assumed to be less than 10 persons, not including occasional visitors.

c. Older process buildings have not generally been designed to resist blast. Protection against high velocity projections was given by traverses, or heavy walls acting as traverses, together with thick roofs. These buildings are not very satisfactory as the weight of structural debris produced when they collapse under blast loading can cause injuries to personnel. Provided that projections can be stopped by suitable traverses, light frangible structures, which on collapsing would not seriously injure the occupants, might be considered as a more suitable alternative. This will depend largely on the type of work, or items stored, in adjacent EO buildings.

d. Personnel protection within process buildings can be improved by designing to resist dynamic forces. This can provide both blast and projection resistant structures or provide a check on existing buildings to determine whether they are liable to collapse.

INHABITED AND NON-INHABITED NON-EXPLOSIVES BUILDINGS

Inhabited Buildings

1.11 Inhabited buildings are those which contain personnel but not EO. The term is usually applied to buildings used by the general public outside an explosives area, but is also used for those buildings inside the Defence boundary that may be affected by a PES, eg Married Quarters, administration areas, etc. All non-explosives inhabited buildings within the IBD of a PES must be designed to resist the expected blast over-pressure and should resist fragments and debris. However, and unusually, where the risk from fragments is low, a Light Structure that would collapse and produce debris that would not seriously injure personnel within may provide a cost-effective alternative.

1.12 The glazing in inhabited buildings is vulnerable to the effects of a blast even at a distance of 2 x IBD (viz purple line) where there is still some risk of injury from flying or falling glass.

Vulnerable Construction

1.13 Serious structural damage, caused by blast, to traditionally constructed low-rise buildings located between IBD and 2 x IBD (ie Yellow and Purple Lines - see Glossary of Terms) should not occur. The breakage of glass and frangible cladding could occur, but the risk of serious hazard to occupants should be minimal. Certain types of construction are known to be susceptible to significant damage at and beyond IBD and may therefore cause injuries and fatalities disproportionate to the scale of the event; this may result either from materials used, eg extensive glazed areas, or from the risk of global collapse which could crush and kill occupants who would otherwise be expected to survive in the open or in more traditional forms of construction. The term ‘Vulnerable Construction’ is used to describe these types of building and require special attention.

1.14 Whilst buildings of vulnerable construction are normally to be sited at a minimum of $44.4Q^{1/3}$, the variation and complexity of modern building materials and construction methods, together with the need to consider usage and population, make it impossible to define universal regulations. A building classified as vulnerable may still be located at the normal IBD if the population is low or measures are taken to protect the population from the potential explosion hazards.

1.15 Guidance to the types of building that might be described as being of Vulnerable Construction, and the factors that will influence the need to locate them outside the Purple Line from a PES are as follows:

a. **Type 1 - Glazed or Other Frangible Curtain Wall Construction.** Buildings that are more than three storeys or 12 m in height constructed with continuous non-load bearing curtain walling with individual glazed or frangible panels larger than 1.5 m^2 and extending over more than 50% or 120 m^2 of the surface of any elevation. This construction is typical of that used in high rise office buildings.

b. **Type 2 - Glazed Wall Construction.** Buildings that are more than three storeys or 12 m in height with solid walls and individual glazing panes or frangible panels larger than 1.5 m^2 and extending over at least 50% or 120 m^2 of any elevation. This construction is also typical of that used in high rise office buildings.

c. **Type 3 - Glazed or Other Frangible Roof Construction.** Buildings that are of more than 400 m^2 plan area with continuous or individual glazing panes larger than 1.5 m^2 extending over at least 50% or 120 m^2 of any elevation. Type 3 buildings encompass the kind of construction typical of that used in covered market buildings, shopping complexes and retail warehouses.

d. **Type 4 - Sensitive Structures.** Building structures that may in themselves be susceptible to disproportionate damage (eg collapse, partial collapse or progressive collapse), including:

(1) Unframed structures with limited continuity utilising non-ductile materials;

(2) Large-span, tension or other special structures with critical load-bearing elements;

(3) Unusually weak structures (typically historic or timber framed buildings);

(4) Buildings containing vulnerable elements such as pre-cast panel fixings, large span slender masonry panels which may be particularly susceptible to failure and lead to a falling debris hazard.

1.16 As a general guide, buildings that stand out either dimensionally or by construction type against a normal background of houses should be subject to closer examination. Cases that fall within or near the vulnerable construction guidelines above, or where it is suspected that they may be particularly vulnerable to blast, require an assessment of the potential risks.

Large Facilities of Special Construction or Importance

1.17 Examples of large facilities of special construction or importance are detailed in Regulation 5.4.

1.18 Where such facilities are not assessed to contain Vulnerable Construction, an assessment of the potential risks must be carried out for each site.

1.19 Where the facilities are assessed to contain Vulnerable Construction, the large facilities are, without exception, to be sited at a minimum QD of $44.4Q^{1/3}$.

Non-Inhabited Buildings

1.20 The construction of buildings in an EO area which are normally unmanned, such as Plant Rooms, Substations, pump houses etc, should be commensurate with the importance attached to the survival of the facility.

BUILDING AND TRAVERSE COMBINATIONS

General

1.21 In the Quantity-Distance Tables of Regulation 5.4, only the combination of an interceptor traverse and a light frangible structure is given as a PES. The traverse gives substantial benefits when the ES is also a light frangible structure. It does not affect other types very much as they are considered to have an integral interceptor or receptor traverse because of their walls or earth cover.

1.22 At an ES, the receptor/container traverse may be combined with a process building in addition to a light frangible structure. If the process building has heavy walls it can also be considered traversed and hence, in general, separate traverses are only used with light frangible structures.

1.23 Except where a special screening traverse is used (see Regulation 6.1 Procedure 2 Annex A), a traverse has little effect on IBD. A traverse is most useful when combined with process buildings to enable QD to be reduced and by careful design, personnel to be given more protection.

1.24 Internal traverses (receptor or interceptor) may be provided within an EO storehouse when propagation of an explosion between individual stacks is to be avoided. Such construction is normally only required when adjacent stacks are of an exceptional nature, eg thin skinned HE EO sensitive to initiation by high velocity fragments, or when QD considerations are such that the hazard from the explosion of the total contents of a building must be reduced.

EXPLOSIVE ORDNANCE BUILDINGS - DESIGN AND CONSTRUCTION REQUIREMENTS

Introduction

1.25 The design and method of construction of EO buildings depends largely on the actual use, but certain features are common to most EO storage and process buildings. These features are given below, followed by the special requirements for storehouses and process building designs.

Structural Materials

1.26 Structural components are to include the following material requirements in the construction of storehouses:

a. Non-combustible materials must be used in the construction of buildings for the storage of EO.

b. Buildings for the storage of bulk explosives relatively sensitive to spark or friction should not have any exposed iron, steel, aluminium or any aluminium alloy containing more than one per cent of magnesium where it may come into contact with explosive substances.

c. Buildings for the storage of EO with toxic chemical hazard should be provided with a non-absorbing material on the floors and the walls to a height at least equal to the top of the stack. The building should have a traverse. The building must be well ventilated.

Fire Protection Requirements and Flammable Materials

1.27 Fire protection requirements are detailed in Regulation 4.7. Flammable materials are to be used as little as possible and those which of necessity are used are to be fireproofed by an approved process or covered with fire resisting material. Hardwood is considered to be sufficiently fire resistant not to require treatment. The use of tar, bitumen or any flammable material, with the exception of asphalt as a water seal on roofs and walls, is forbidden.

Notional Periods of Fire Resistance

1.28 The highest grading for an estimated time of fire resistance is approximately four hours and this can be provided by:

a. Load bearing concrete, ie 180 mm of reinforced concrete with a minimum concrete cover of 25 mm over reinforcement, or 130 mm of concrete with 12 mm of vermiculite-gypsum plaster. The concrete will require to be made of Class 1 aggregate, ie foam slag, pumice, blast furnace slag, pelleted fire ash, crushed brick and burnt clay products.

b. Non-load bearing concrete, ie concrete walls of 150 mm thickness composed of Class 2 aggregate, ie flint gravel, granite and all crushed natural stone, other than limestone.

c. Load bearing brickwork, ie walls of 230 mm thickness or of 100 mm thickness plastered with 12 mm vermiculite-gypsum or pearlite-gypsum (to clay bricks only).

d. Non-load bearing brickwork, ie walls of 180 mm thickness or 110 mm thickness plastered with vermiculite-gypsum or pearlite-gypsum.

Bonding of Metal

1.29 All structural steelwork used in the construction of an EO building, including the reinforcement in concrete structures, is to be effectively bonded to the lightning protection system (in accordance with Regulation 6.3 Procedure 1) to avoid damage or fire due to side flash, where its position in relation to roof or door conductors may offer an alternate path to earth.

Electrical Services and Earthing Requirements

1.30 The requirements for electrical services are detailed in Regulation 6.3 Procedure 1. When specified, storage and EO process buildings are to be fitted internally with a copper earthing strip, continuous around the walls at a height of approximately 1m. This earthing strip is to be bonded to the lightning protection system (see also paragraph 1.73). The requirement for 'touch plates' at the entrances to EO process buildings is detailed in Regulation 6.3 Procedure 2.

Floors

1.31 For EO storehouses and process buildings, the floors are to be of concrete on a hard core base. In certain types of process buildings of heavy construction, the concrete is to be reinforced. To make such floors dust free they are to be treated with sodium silicate or other similar approved substance. The floors of magazines and EO workshop are also to be of concrete but are to be surfaced with an approved gritless covering or, alternatively, well-fitted linoleum may be used. Precautions are to be taken to prevent explosive dust getting under a semi-permanent floor covering. The strength of the floor is to be such that it will withstand the required loading densities.

1.32 The floors of any building in which electro-explosive devices, or stores containing such devices, are inspected, tested or prepared, are to be of the conducting (0 to 50 x 10^3 ohms) or anti-static (50 x 10^3 to 2 x 10^6 ohms) type. Anti-static flooring must be used when personnel protection from electric shock is required, eg where the procedures require the use of mains operated test equipment. The conducting material used for either type of floor is to be bonded to the lightning protection system of the building - see Regulation 6.3 Procedure 2 for details.

1.33 In existing buildings where special floors have not been provided, a low resistance path to earth of less than 50 x 10^3 ohms can be obtained at each working area by providing metal plates bonded to the common earthing system of the building. Where metal plates are used, one such plate is to be placed inside the access doorway in such a position that personnel will dissipate body static through their conductive shoes before entering the working area. In buildings in which the use of medium or high voltage test equipment is required, and its use with metal plates would present a risk to the operator under fault conditions, a residual current device (RCD) must be fitted (see also paragraph 1.74 and Regulation 6.3 Procedure 2 and Regulation 4.4 Procedure 5.

Walls

1.34 The types of material used for wall construction vary with the type and use of the buildings, with due regard also being given to ES and other PES in the vicinity, but the following minimum standards should be applied:

a. Explosive Ordnance Storehouses:

(1) Light frangible construction in accordance with paragraph 1.5.

(2) If protection is required against penetration by debris, low velocity projections and lobbed EO, construction in accordance with paragraph 1.58 is required.

(3) If protection is required against high velocity primary fragments, construction in accordance with paragraph 1.60 is required.

b. Explosive Ordnance Workshops:

(1) Light frangible construction in accordance with paragraph 1.5. Medium-walled buildings, as described in paragraph 1.6, are unsuitable for EO workshops because of the debris effects from a potential incident.

(2) Reinforced concrete construction or heavy brick wall construction in accordance with paragraphs 1.65 to 1.70 inclusive.

(3) If it is intended that explosive substances may be exposed, the internal walls of the facility are to be faced with glazed tiles. Alternatively, the internal walls are to be faced with good quality hard plaster and finished with approved high gloss paint. See paragraph 1.60 for further details.

c. Explosive Ordnance Preparation Buildings:

(1) **High-blast and Fragmentation EO.** The preferred construction for preparation buildings for EO of high blast and fragmentation characteristics, eg HE bombs, depth charges, hand grenades, HE ammunition and shell, is light frangible construction consisting of a car-port type roof with either earth or vertical wall traversing. Alternatively, buildings of heavy-wall, earth-covered or igloo construction (see paragraphs 1.7 to 1.9) may be used.

(2) **Pyrotechnics EO.** Wall construction in accordance with sub-paragraphs b(1) and (2) is preferred for preparation buildings for pyrotechnics EO such as practice bombs, smoke grenades and countermeasures.

(3) **Rocket Propelled EO.** Wall construction in accordance with sub-paragraphs b(1) and (2) is preferred for assembly and maintenance buildings for missiles and rockets. Regard must also be given to the prescriptions of paragraphs 1.54 to 1.56 inclusive.

(4) **Low-blast fragmentation EO.** Wall construction in accordance with sub-paragraphs b(1) and (2) is preferred for preparation rooms for small arms ammunition.

NOTE

If internal compartments in buildings in sub-paragraphs c(2), (3) and (4) are required, internal wall traversing is to be in accordance with Regulation 6.1 Procedure 2.

(5) **Electro-Explosive Devices (EED).** Wall construction for EED preparation rooms with the Process Building Distance (PBD) is to be in accordance with sub-paragraphs b(1) and (2). EED preparation rooms sited at distances greater than PBD are to have wall construction of a strength sufficient to prevent the escape of high velocity projections, eg 230 mm solid brick or 275 mm cavity brick or equivalent.

NOTE

When very small quantities of EO (less than 68 kg NEQ) are involved, the thickness of the walls may obviate the necessity of providing other traverses. Information on this subject is contained in Regulation 6.1 Procedure 2.

Roof Construction

1.35 The roofs of buildings within an EO area are preferably to be either all heavy or all light, a heavy roof being one of concrete at least 150 mm thick or its equivalent. Light roofs (usually pitched roofs) are to be covered with metal sheeting and metal trusses are normally to be used, but for small buildings hardwood trusses are acceptable. Concrete roofs, which are themselves not waterproof, may be provided with an asphalt finish to make them watertight using mineral based felt to provide a flexible joint between concrete and asphalt. Arrangements are to be provided on all roofs for rainwater discharge into open channels or gullies. Whilst heavy roofs are preferable for all buildings, the decision on the type of roof to be provided will be determined by the EO to be housed and the existing local circumstances. Where light roofs are provided, there is a greater possibility of propagation of fire or explosion and, in certain circumstances where HD 1.2 EO are concerned, greater quantity-distances are necessary. Additionally, arrangements are to be made to exclude birds from eaves and roofs to prevent nesting.

Doors

1.36 Doors are to open outwards and should be of a minimum standard of 6 mm steel, or 50 mm of hardwood or its equivalent with 1.6 mm steel sheet and, other than escape doors, are to be fitted with a mortice lock, a padlock also being provided if required for additional security. Sliding doors are either to be provided with an outwards opening wicket door in them or immediately adjacent to them. Additional escape doors are to be provided in large buildings; such doors are not normally fitted with locks but are to have bolts on the inside and a simple quick release device that will operate under pressure on any part of the door. A wicket door which is used for both access and escape may be fitted with a mortice lock in place of the internal bolts but such mortice locks are to be operable only from the exterior of the building. No building is to have more than one escape door fitted with a mortice lock. The pins of the hinges used are to be adequately secured to prevent their easy withdrawal. These requirements are the minimum for security purposes; for requirements to prevent penetration by debris etc., see paragraph 1.58.

Windows

1.37 It is desirable that windows are not allowed in EO storehouses, but are permitted in other EO buildings. Where windows are allowed, they are to be of the non-opening type and are to be glazed with wired obscure glass. They are normally to be positioned to avoid the entry of direct sunlight into the building, ie the north side in the northern hemisphere and the south side in the southern hemisphere. Where possible the windows of one building are to face the blank wall of an adjacent building or a traverse. Metal-framed windows are preferable to those made of hardwood. In existing buildings where opening type windows have been provided, and where there are no security objections to them remaining in this state, stout, small mesh metal grilles are to be provided, firmly secured to the window frame or the structure of the building.

Ventilation

1.38 High and low level ventilators are to be provided in all buildings that are not air conditioned. The ventilators may be either controllable from the exterior of the building or of a permanently open type such as a honeycomb brick but, where necessary, small mesh metal grilles are to be provided to prevent sabotage devices being thrown into the building. If the ventilators so provided are inadequate and exhaust fans are necessary, they are to be fitted on the leeward side of the building, relative to the prevailing winds. Suitable automatic louvres, fitted with small mesh metal grilles where necessary, are to be provided to ensure that there is no ingress of air when the fans are not running. All ventilators are to be fitted with suitable shields to prevent the ingress of rain, snow or sleet where these elements are found to cause deterioration of storage conditions. In hot climates it may be necessary to provide small mesh metal grille doors additional to the normal doors to enable the buildings to be adequately ventilated during the night. The small mesh metal grille doors are to be provided with locks of an approved pattern. In buildings in which air conditioning has been provided but which is no longer required, provision is to be made for natural ventilation to the requirements of these instructions.

Air Conditioning

1.39 Where it is necessary to provide air conditioning to meet specified humidity conditions, the plant provided is to comply with the requirements of these instructions in so far as they are applicable.

Heating

1.40 Heating may be provided by means of steam at a pressure of 104 kPa, by hot water, or by electricity to the requirements of Regulation 6.3 Procedure 2. Where steam or hot water is used, the pipes may be of iron but they are to be fixed clear of the walls, at least 1.9 m above the floor, and not less than 150 mm from any woodwork. Pipes are not to be covered other than with an approved paint and the control valves are, where possible, to be situated outside the building. The surface temperature of any heating apparatus is not to exceed the limits given in Regulation 6.3 Procedure 2. Suitable guards are to be provided to prevent EO or their packages coming within 600 mm of the radiators or any pipes serving them. Oil or gas fired and solid fuel boilers are normally to be outside the EO area, but if located within the area they are to be not less than 50 m from any EO building.

Cooling

1.41 In hot climates, arrangements are to be made to keep the contents of the building as cool as possible by providing an interior ceiling or double roof and extending the width of the roof to protect the walls from the direct rays of the sun. In some buildings, where the temperature range is critical, insulating materials may have to be used. Alternatively, either earth–covered above-ground or semi-underground buildings may be desirable.

Artificial Lighting

1.42 EO buildings are normally to be provided with mains supply electric lighting to the appropriate standard laid down in Regulation 6.3 Procedure 1. Approved portable battery operated lights may be used in EO buildings on a temporary basis provided their construction is appropriate to the electrical category of the building in question.

Internal Decoration

1.43 The interior of EO buildings may be painted or colour washed with some light colour, preferably white or cream. Oil bound water paint is suitable for storehouses but approved non-lead paints are to be used for magazines and EO workshops. Aluminium paint is not to be used on ferrous metals nor, other than as a primer in accordance with an approved paint scheme, on other materials.

External Decorations

1.44 Doors, window frames, etc, are to be painted in colours to suit local requirements. In hot climates consideration is to be given to colour washing, or painting in white or with aluminium, the whole of the exterior of the buildings to reduce the internal temperature.

Lead-Free Requirements

1.45 The new internal fitments for all EO buildings are to be fabricated of commercial materials not containing lead as an ingredient. All paints used within the buildings are also to be lead free.

Lifting Appliances

1.46 Buildings intended to contain heavy or bulk stores are either to be provided with overhead cranes, or the construction of such buildings is to be such that mobile lifting and stacking appliances can be used.

Size of Explosive Ordnance Buildings

1.47 The size of an EO building is determined by the intended use of the building, the quantity of stores to be placed therein and their permitted stacking heights, or the types and sizes of the handling devices to be used. As a guide, for a normal storage building 50 per cent of the floor space is required for essential gangways, etc (see also Regulation 6.3 Procedure 3).

Type Designs

1.48 Type designs are usually available to guide the planning of all EO buildings. These designs are to be altered as necessary to meet any specific requirement not catered for in the designs.

EXPLOSIVE ORDNANCE STOREHOUSE DESIGN - TYPE DESIGN ASPECTS

Igloo Performance Criteria for Exposed Site

1.49 Storehouses of igloo construction are to be designed to meet the following criteria:

a. The structure must be designed to a 90 per cent confidence level that it will not collapse nor will the doors fail when exposed to the blast loading due to an accidental explosion in an adjacent structure at standard Inter-Magazine Distances.

b. Deflection of components should be limited in order to maintain structural integrity, and so that they will not be larger than the width of the air gap around the contents, to avoid the structure striking the contents. The support rotations of all RC elements and the steel doors are to be limited to 4 degrees and 12 degrees respectively.

c. The major spalling of the RC elements of a structure should be prevented to avoid initiation of stored explosives. To avoid major spalling the spall velocities should be limited as follows:

(1) For a spall velocity greater than 50 m/s the kinetic energy should not exceed 2500 Joules.

(2) For a spall velocity less than 50 m/s the momentum should not exceed 100 Ns.

1.50 These limits will not necessarily prevent the initiation of sensitive primary explosives but should avoid the initiation of all other types.

1.51 Full-scale or model tests of at least 1/10 scale may be used to justify the design. Alternatively, the design may be compared analytically with igloos that have been proof tested. Blast data to assist with analytical comparisons is located in Annex H. Recommended design modes for igloos at an ES, based on model and full-scale tests are given in paragraphs 1.52 to 1.54.

'Side-On' Conditions - The 3-Bar Igloo

1.52 When igloos are constructed with their axes parallel, account must be taken of explosion effects in a side-to-side situation. The separation or Inter-Magazine Distance (D3) is given by $0.5Q^{1/3}$, where Q is the Net Explosives Quantity (NEQ) in kg. The blast parameters for the dynamic design of the structure are as follows:

a. The head-wall, doors, rear and side-walls dynamic design loads:

Peak positive overpressure = 3 bar

Positive duration = $1.0Q^{1/3}$ms

Positive impulse = $1.0Q^{1/3}$bar ms

b. The roof dynamic design loads:

Peak positive overpressure = 6 bar

Positive duration = $1.0Q^{1/3}$ms

Positive impulse = $1.0Q^{1/3}$bar ms

'End-On' Conditions - The 7-Bar Igloo

1.53 When igloos have the same longitudinal axis and the headwall and doors of one are exposed face-on to the blast from the rear wall of another, the separation or Inter-Magazine Distance (D4) is given by $0.8Q^{1/3}$ (igloos should not be sited with their doors facing each other). The blast parameters for the dynamic design of the structure are as follows:

a. The head-wall, doors (and rear wall if the position is reversed) dynamic design loads are:

Peak positive overpressure = 7 bar

Positive duration = $1.0Q^{1/3}$ms

Positive impulse = $2.0Q^{1/3}$bar ms

b. Roof and side wall dynamic design loads are as for the 3 bar igloo (paragraph 1.52).

Rebound and Fragment Attack

1.54 The igloo door should be designed to resist rebound in the negative phase of the blast wave. An equivalent static pressure for support restraint design would be 0.5 bar over the door surface. Fragment attack on the door and head-wall is not of prime significance provided that the members are traversed or end-on conditions apply. Typical fragments would be hard rocks of much less than 1 kg mass and of a velocity of up to 300 m/s. These would be resisted by a mild steel door of total plate thickness of 20 mm.

Storehouses for Self-Propulsive Missiles and Rockets

1.55 As well as those general design features given in paragraphs 1.27 to 1.48 inclusive, the additional requirements for storehouses for self-propulsive missiles are given in paragraph 1.56.

1.56 The general principle for the storage of self-propulsive missiles is to prevent missiles escaping from the confines of the storage building traverse. The safest storage for such weapons, particularly those with explosive warheads, is an earth-covered building or igloo. If buildings of those types are not available, it is possible to reduce the possibility of the missiles escaping by ensuring that the heads are pointed towards a vertical faced wall or traverse, by storing the missiles nose down or the missiles may be anchored to the structure or fitted with spoilers. For horizontal storage, walls or traverses are to be strong enough to withstand the thrust of one missile firing accidentally and the missiles are to be stored so that in the event of ignition, forward movement is arrested before the missile is armed. The venturi from one missile is not to point at the open venturi of any other missile. Whenever possible missiles should face in the same direction outwards (away from other stack or storehouses). Control of ventilation is to be provided in all self-propulsive missile buildings. The risk of loss of the whole stocks within a building is to be acceptable. The alternatives are:

a. **Missiles up to 80 mm Diameter.** Missiles up to 80 mm diameter may be stored in the manner described below and in buildings which meet the following construction requirements:

(1) Missiles may be stored in any non-flammable building with traverses positioned close to the building. Missiles are to be stored with their heads as close to the wall as possible to prevent forward movement in the event of accidental ignition of the motor. Unpacked missiles are not to be stored venturi to venturi. Packaged missiles may be so stored against any wall of a building. Vertical faced traverses are to be provided on the side of the building against which the heads of the missiles are stacked. Remaining traverses may be double sloped.

(2) Missiles may also be stored in any non-flammable buildings which have walls and/or internal partition walls at least 330 mm brick or equivalent. Missiles are to be stored as close to the walls as possible. The buildings are to be traversed.

(3) Missiles may also be stored in any suitable non-flammable building with less than 330 mm walls, stacked single tier, nose down. Vertical faced traverses are to be provided.

b. **Missiles over 80 mm Diameter (may also be applied to missiles of less than 80 mm diameter).** Missiles over 80 mm diameter may be stored in the manner described below and in buildings which meet the following construction requirements:

(1) Buildings for long term storage are to be of light construction with all round weather protection. Walls of the buildings are to be frangible so as not to impede the exit of the missile from the building. Vertical faced traverses are to be provided on the sides of the building facing the heads of the missiles. Traverses are to be at such a distance that, whilst permitting the missiles to escape from the building and burn outside, will not permit the missiles to arm. Whilst this separation distance will reduce the risk of loss of the remaining stock

it does not completely remove the risk of warhead explosion on impact or propagation by fire or explosion.

(2) Unpackaged missiles are not to be stored venturi to venturi. Packaged missiles may be stored facing any wall of the building. Missiles are to be stored as close to the wall as possible but never more than twice the length of the missiles from its head to the vertical faced traverse.

(3) Missiles may be stored single tier, nose down, in any suitable non-flammable building. Vertical faced traverses are to be provided.

Special-To-Type Missile Storehouses

1.57 Where a missile manufacturer has recommended specific requirements for storage, facilities designed to store such missiles must conform to those recommendations.

OTHER DESIGN REQUIREMENTS FOR EXPLOSIVE ORDNANCE STOREHOUSES

NOTE

The following requirements apply to all storehouses. 'Approved' igloos will comply with them without additional strengthening.

Protection against Projections

1.58 EO storehouses should be strong enough to resist penetration by debris, low velocity projection and lobbed EO. The minimum requirements to achieve this are:

a. Roof: 150 mm RC slab.

b. Walls: 150 mm RC or 230 mm brickwork.

c. Door: 20 mm thick mild steel (MS) plate.

1.59 Provided the head-wall and door comply with this an earth covered building will give full protection.

1.60 To give protection against high velocity primary fragments, a traverse or earth cover should be provided. However, walls of minimum thickness of 680 mm brick or 450 mm RC will generally be enough to prevent initiation of the storehouse at the ES but in this situation the door should be equivalent to 50 mm MS plate.

Pressure Release

1.61 Storehouses for HD 1.3 EO should incorporate a weak section to permit rapid release of internal pressure. The unit mass of this weak section should be as low as possible under the circumstances, but in any case should not be much greater than 50 kg/m^2. The open end wall of an earth covered building should normally be designed as this weak section. Such a weak section should not be in line-of-sight of the weak section of adjacent storehouses unless the separation distances are sufficient to prevent propagation by projected pieces of burning HD 1.3 propellant and other items. The weak section will not be sufficient to resist debris, etc from a PES containing HD 1.2 EO.

Design Loads for Explosive Ordnance Storehouses at an ES

1.62 Annex B gives a table of expected overpressures and scaled impulses for the various separation distances given in Regulation 5.4 Procedure 1 Annex A Table 1. Where the PES is an igloo or earth covered building, these parameters will be reduced in the near field (viz less than D9) provided that the ES is not in the line-of-sight of the head wall – see Annex C.

Protection against Initiation by Debris

1.63 A storehouse adjacent to a PES should be constructed so that debris from the PES, projected or falling on it will not cause the ES contents to be initiated. Annex D gives estimates for the velocity of structural components at an ES projected by bare charges of various weights at a PES. Tests indicate that initiation of uncased or lightly cased HD 1.1 EO is likely to occur when debris velocity is greater than 100 m/s with a momentum of about 400 Ns.

1.64 It is recommended that a storehouse at an ES should have components of sufficient mass and/or be positioned at a great enough separation distance so that debris velocities do not exceed 50 m/s.

PROCESS BUILDING DESIGN

Introduction

1.65 This section covers personnel protection in process buildings. It is beyond the scope of this instruction to give detailed guidance about all the different types of buildings required for explosives manufacturing and testing. Some examples of process buildings and also special purpose built buildings are shown in Annex E.

Design Fundamentals

1.66 The main aim of process building design should be to produce an acceptably safe building at the least cost. The following options should be considered:

a. Obtain the minimum IBD and PBD by careful siting.

b. Sub-divide process buildings into traversed compartments so that a low NEQ (unit risk) is obtained in each compartment and hence a reduced QD can be used instead of that for the total explosive content of a building.

c. Prevent collapse of buildings by blast-resistant design or by use of RC wall traverses.

d. Reduce projections from the PES by the smothering effect of the earth cover or by providing interceptor or container traverses.

e. Accept that buildings will collapse at the ES but by using frangible lightweight materials, ensure that debris produced therefrom will not be a great hazard to personnel. Such materials should be used at a PES to reduce the hazard from projections.

f. Provide receptor traverses to protect ES from hazards arising from the PES.

Reinforced Concrete Design Parameters - Exposed Sites

1.67 Reinforced concrete structures at exposed sites are to meet the following design parameters:

a. The ES structure should be designed to a 90 per cent confidence level that it will not collapse and doors/openings will not fail.

b. Deflection of components should be limited to 2º support rotation or span/60 maximum deflection. If 4 mm MS spall plates are provided the above can be increased to about 4º or span/30 respectively.

c. Design loads may be obtained from Annex F. No allowance should be made for the effect of earth cover except in the design for ‘normal’ working load.

d. Details of the concrete and steel should be:

(1) Minimum concrete grade: U = 25 M/mm^2 (28-day cube strength). Reinforcement to be mild steel or hot rolled high tensile bars - maximum dynamic design tensile strength to be not greater than 110 per cent, code static value.

(2) Minimum tensile reinforcement = 0.25 per cent x sectional area. Secondary reinforcement = 0.2 per cent x sectional area. Nominal links to be used in all slabs and walls: 0.1 per cent plan area where compression reinforcement is present. 0.04 per cent plan area where compression reinforcement is used.

Brickwork Design Procedure

1.68 The following procedure is to be followed in determining brickwork design for process buildings at Exposed Sites:

a. Determine whether the brickwork can resist the blast load or whether it collapses at the ES and produces debris.

b. Resistance to the dynamic load may be calculated using a mortar tension stress of 0.20 N/mm^2, although this value is only approximate and could reduce to zero if the brickwork is old. For NEQ above 18 000 kg the following table may be used as a preliminary check:

Brick Wall Thickness at the ES (mm)	Separation Distance below which the wall may collapse if NEQ is equal to or greater than 18 000 kg (m)
112	540
225	360
340	320
450	220
700	100

Table 1–1: Resistance to Dynamic Load (NEQ above 18 000 kg)

c. The following table, based on wartime tests, indicates the likely damage to brick or plain concrete wall panels for various levels of face on reflected impulse (i_r):

Type of Panel	Effect	I_r (Face on) reflected impulse (bar msec) per 25 mm wall thickness		
		Free Edge Cantilever	Two Edges Supported (Buttressed)	Four Edges Supported (Buttressed and Return Walls)
Brick Wall (approx 2m square)	Crack	0.46	0.62	0.90
	Demolish	0.83	1.10	1.65
Plain Concrete	Crack	0.83	1.17	1.65
	Demolish	1.52	2.07	3.03

Table 1–2: Likely Damage to Brick or Plain Concrete

d. The rate of brickwork collapse may be found from Annex D. This gives debris velocity at an ES for various QD. Alternatively, debris velocity may be found by using blast parameters from Annex F in the equation:

$$V = \frac{100\,(i_r \text{ or } i_s)}{m_a}$$

Where: i_r or i_s = reflected or 'side on' blast impulse in bar msec
m_a = absolute mass/unit area of wall in kg weight/m^2
V = debris velocity in m/s

The above calculation assumes that the brick wall has no tensile strength to resist horizontal forces. The results are conservative and assume blast loading is on one face of the wall only.

Injury to Personnel from Debris

1.69 The maximum kinetic energy of a projection should not exceed 80 Nm to avoid serious injury. A typical projection, eg a half brick, would have a velocity of 9 m/s at this level of kinetic energy. Building components collapse velocity should, therefore, be restricted to about 10 m/s or less.

1.70 Debris (secondary fragments) from a PES could cause injury to personnel. Tests indicate that crater ejecta from a bare charge have a maximum range (m) of $30Q^{0.4}$ for rock and $12Q^{0.4}$ for soil. Annex A gives probability curves for a strike of one or more projections on a standing person (exposed area = 0.58 m^2) for various charge weights and ranges. (This does not include primary fragments).

Frangible Materials

1.71 The ideal frangible material would be strong enough to use as a structural component, would have adequate intrusion or physical security characteristics, would resist fragments at an ES and would break up into small harmless fragments at a PES. In practice it is difficult to satisfy all these criteria, as most of the lightweight materials have negligible fragment resistance and in addition some can give rise to dangerous sharp edged projections. Frangible material is primarily used to form weak panels to provide easy venting and to prevent build up of blast pressure in cubicles and buildings. The mass per unit area should not exceed 50 kg/m^2 for venting HD 1.1 EO and, if practicable, be appreciably lower than this, particularly for HD 1.3 EO. Physical security must also be taken into consideration.

1.72 Typical frangible materials used in process building construction are listed and commented upon below. However, tests should be conducted if there is any doubt concerning how a specific material behaves on fragmentation:

a. **Glass Reinforced Polyester (GRP).** An excellent frangible material. GRP panels are strong yet produce very small light-weight fragments of negligible velocity. Only grades of this material should be used which on shattering produce fragments with soft feathery edges and not sharp cutting edges. Unit mass = 2.20 kg/m^2 per mm thickness.

b. **Wood or Plywood Sheet.** Used as a lightweight material (high strength to weight ratio), cheap and produces light fragments. Flammable unless specially treated and could absorb explosives dust. Sections greater than 25mm thick may produce heavier fragments. Unit mass = 0.6 kg/m^2 per mm thickness.

c. **Asbestos Sheeting.** No longer acceptable for use as a construction material because of attendant health risks.

d. **Corrugated Iron Sheeting.** Lightweight and strong. Is easily stripped off and therefore provides good venting. Sheets do not disintegrate as well as the above and could present an unacceptable hazard. Aluminium sheeting behaves similarly but is less hazardous.

e. **Proprietary Lightweight Panels.** These could be used and if made of fibreboard or plastic would reduce fragment hazard. Often they incorporate metal sheeting that has the same disadvantages as corrugated iron.

f. **Glass.** Good frangibility but produces extremely dangerous fragments. Must have Anti-Shatter Film (ASF) applied to keep the pane in one piece, together with weighted nylon curtains to retain the pane. Alternatively, replace the pane with 2 mm polycarbonate sheet or layers of clear PVC. Another possible alternative is 7.9 mm thick laminate glass with 30 mm rebate but this might not provide good venting. All glass in process buildings must be treated or removed to prevent fragment damage.

Process Buildings - Type Construction

1.73 EED Preparation Rooms. In EED preparation rooms, in addition to the requirements of paragraphs 1.29 and 1.30, the following are required:

a. An earthing device, such as a touch knob, hand bar or plate bonded to the common earthing system, is to be placed inside the access doorway to enable personnel to dissipate body static by bare hand contact before entering the working area.

b. The working surfaces, blast shields and storage facilities are to be of metal or metal covered, and bonded to the common earthing system.

1.74 Explosive Ordnance Workshops. The method of construction of an EO workshop will depend on its grade and the operations for which it is intended (see Regulation 4.4 Procedure 5). Annex G gives constructional requirements for the various grades of workshops from which can be extracted the specific requirements to meet the actual circumstances.

1.75 Special to Type Missile Assembly and Maintenance Buildings. Where a missile manufacturer has recommended specific requirements for assembly and maintenance, facilities designed for the specific missile must conform to those recommendations.

Annexes:

ANNEX A

CRATER EJECTA CRITERIA FOR PERSONNEL IN THE OPEN

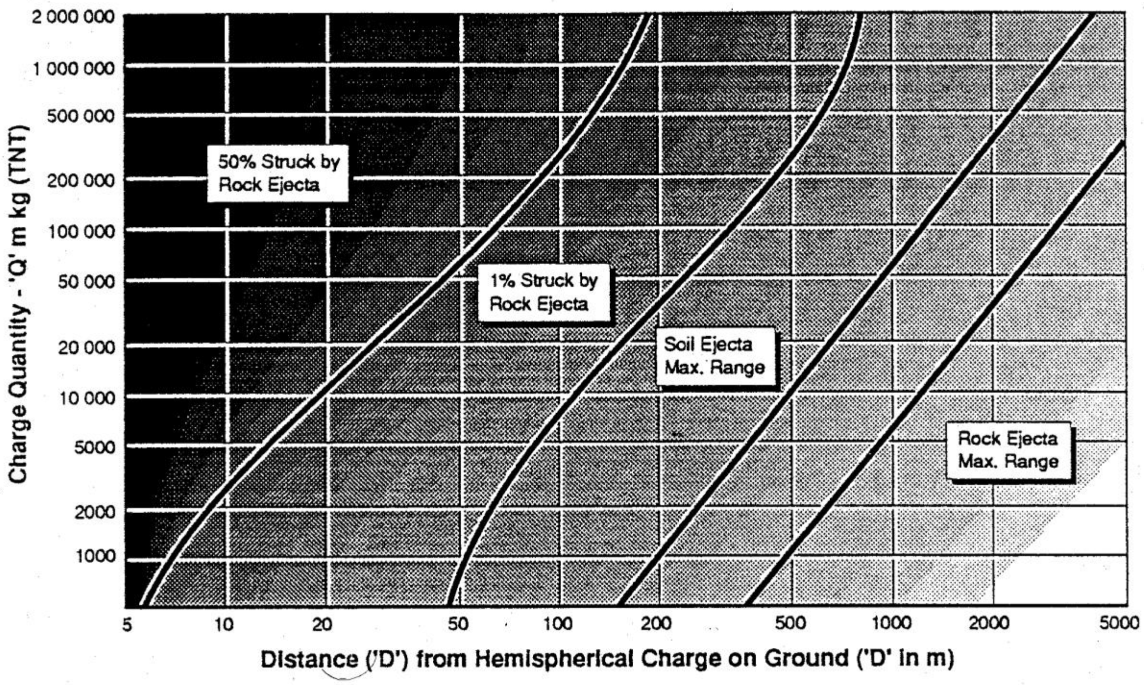


Figure 1-A-1 Crater Ejecta Criteria for Personnel in the Open

ANNEX B

DESIGN LOADS FOR BUILDINGS AT STANDARD QUANTITY DISTANCES FROM AN EXPLOSION OF A BARE HEMISPHERICAL CHARGE OF TNT

Quantity Distance	Distance Function	'Side On'		Remarks and Buildings Affected
		Overpressure Pso	Impulse Iso	
'D'	'D' in m	bar or mbar	bar msecs	Units
D1	0.35 $Q^{1/3}$	77 bar	2.06 $Q^{1/3}$	Traversed modular bomb stacks only
D2	0.44 $Q^{1/3}$	61 bar	1.97 $Q^{1/3}$	Traversed modular bomb stacks only
D3	0.5 $Q^{1/3}$	50 bar	1.95 $Q^{1/3}$	Igloos
D4	0.8 $Q^{1/3}$	23.5 bar	1.88 $Q^{1/3}$	All magazines
D5	1.1 $Q^{1/3}$	12 bar	1.87 $Q^{1/3}$	Igloos & earth covered buildings
D6	1.8 $Q^{1/3}$	3.5 bar	1.61 $Q^{1/3}$	Igloos
D7	2.4 $Q^{1/3}$	2 bar	1.35 $Q^{1/3}$	All magazines
D8	3.6 $Q^{1/3}$	800 mbar	0.99 $Q^{1/3}$	Igloos & earth covered buildings
D9	4.8 $Q^{1/3}$	500 mbar	0.72 $Q^{1/3}$	All magazines except heavy walled buildings & process buildings if Q < 500 kg
D10	8.0 $Q^{1/3}$	200 mbar	0.45 $Q^{1/3}$	Process Building Distance (PBD)
D11	1.0 $Q^{1/3}$	<=400 mbar	<=3.65	Q < 2500 kg Public
	3.6 $Q^{1/3}$	<=100 mbar	<=4.15	2500 < Q < 4500 kg Traffic Route
	14.8 $Q^{1/3}$	90 mbar	0.24 $Q^{1/3}$	Q > 4500 kg Distance
D12	22.2 $Q^{1/3}$	50 mbar	0.17 $Q^{1/3}$	Igloos, earth covered buildings & untraversed bare stacks
D13	1.5 $Q^{2/3}$	<=200 mbar	<=2.50	Q < 2500 kg Inhabited Building Distance
	5.5 $Q^{1/2}$	<=60 mbar	<=2.77	2500 < Q < 4500 kg
	22.2 $Q^{1/3}$	50 mbar	0.17 $Q^{1/3}$	Q > 4500 kg The 'Yellow Line'
	44.4 $Q^{1/3}$	25 mbar	0.06 $Q^{1/3}$	2 x IBD The 'Purple Line'

Table 1B–1: Design Loads for Buildings at Standard Quantity Distances from an Explosion of a Bare Hemispherical Charge of TNT

NOTES

1. Parameters given for a bare hemispherical TNT charge weight 'Q' kg on the ground at a distance 'D' metres from charge.

2. For reflected or 'face on' pressure (Pr) & impulse (Ir) see Annex F.

3. Where PES is an igloo or earth covered building, loads will be reduced, see Annex C for experimental values.

4. The overpressure and impulse values were calculated using airblast parameters from a TNT spherical air burst and hemispherical surface burst by Charles N Kingery and Gerald Bulmarsh, April 1984.

ANNEX C

DESIGN LOADS FOR BUILDINGS WHERE THE PES IS AN IGLOO OR EARTH-COVERED BUILDING

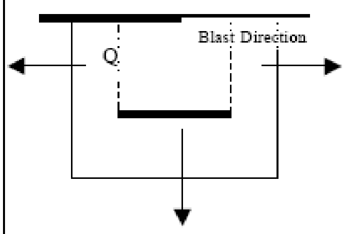
Quantity Distance 'D'	Distance Function 'D' in m	'Side On'		Remarks
		Overpressure Pso bar or mbar	Impulse Iso bar msecs	Units
D3	0.5 $Q^{1/3}$	4.5 bar	1.10 $Q^{1/3}$	
D4	0.8 $Q^{1/3}$	3 bar	0.80 $Q^{1/3}$	
D5	1.1 $Q^{1/3}$	2 bar	0.76 $Q^{1/3}$	
D6	1.8 $Q^{1/3}$	1.1 bar	0.67 $Q^{1/3}$	
D7	2.4 $Q^{1/3}$	900 mbar	0.61 $Q^{1/3}$	
D8	3.6 $Q^{1/3}$	550 mbar	0.52 $Q^{1/3}$	Values apply only for ES in directions shown.
D9	4.8 $Q^{1/3}$	400 mbar	0.41 $Q^{1/3}$	

Table 1C–1: Design Load for Buildings where the PES is an Igloo or Earth-Covered Building

NOTES:

1. For igloo design at distances D3 and D4 use parameters given in paragraphs 1.50 and 1.51.

2. The data given is experimental and should be used with caution. No account has been taken of the 'Debris Impulse' that is enhanced for Igloos and earth-covered buildings. It could be detrimental to buildings other than igloos or earth-covered buildings.

3. For distances greater than D9, blast parameters revert to those from a 'bare' charge so Annex B should be used.

4. Data obtained from B.C.L. Memorandum No 2680 'Blast Parameters from Explosions in Model Earth Magazines' (1/30 scale tests) by C. Kingery.

ANNEX D

WALL DEBRIS VELOCITIES AT ES FOR VARIOUS CHARGE WEIGHTS

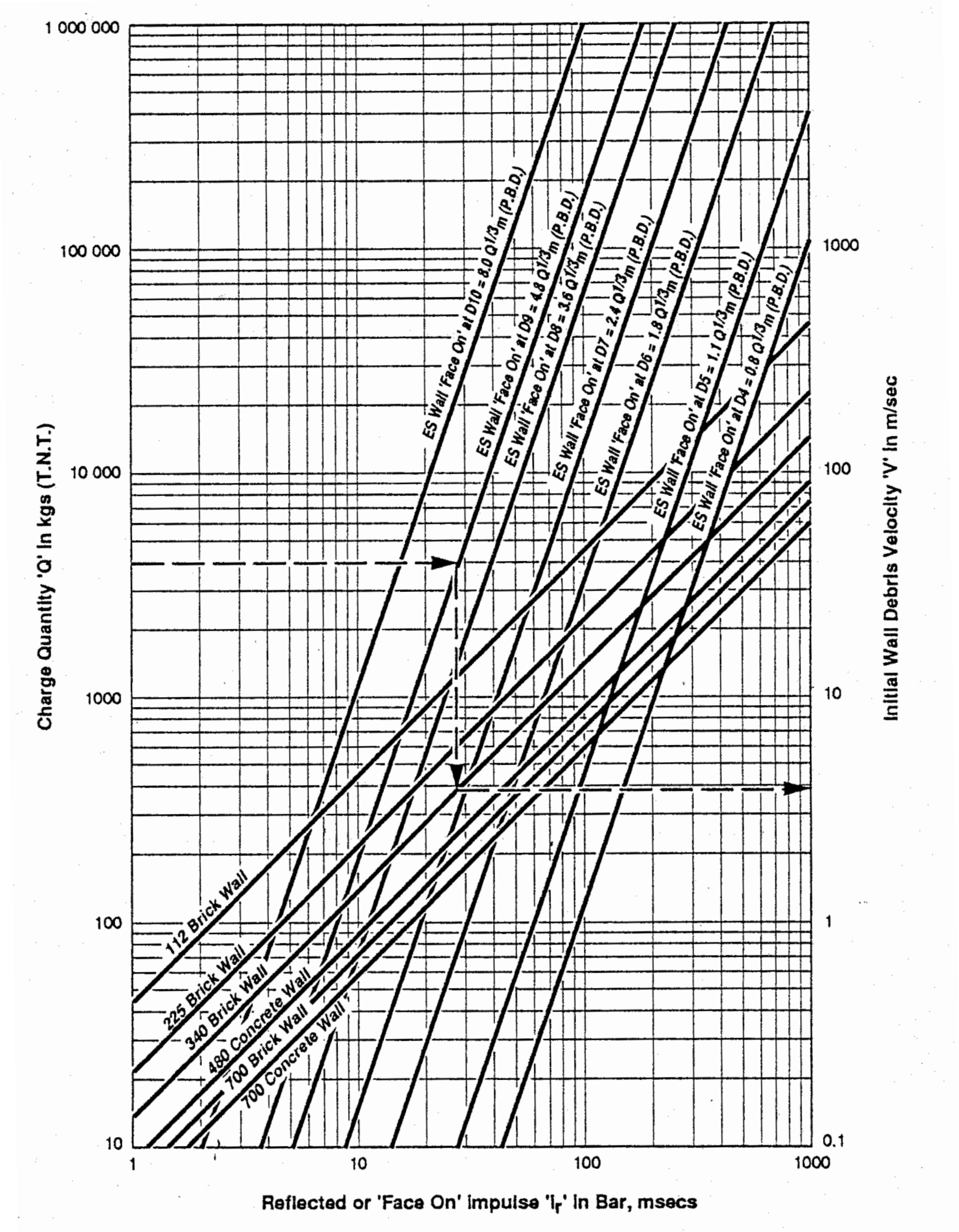


Figure 1-D-1 Wall Debris Velocities at an ES for Various Charge Weights

ANNEX E

EXAMPLES OF PROCESS BUILDING DESIGNS

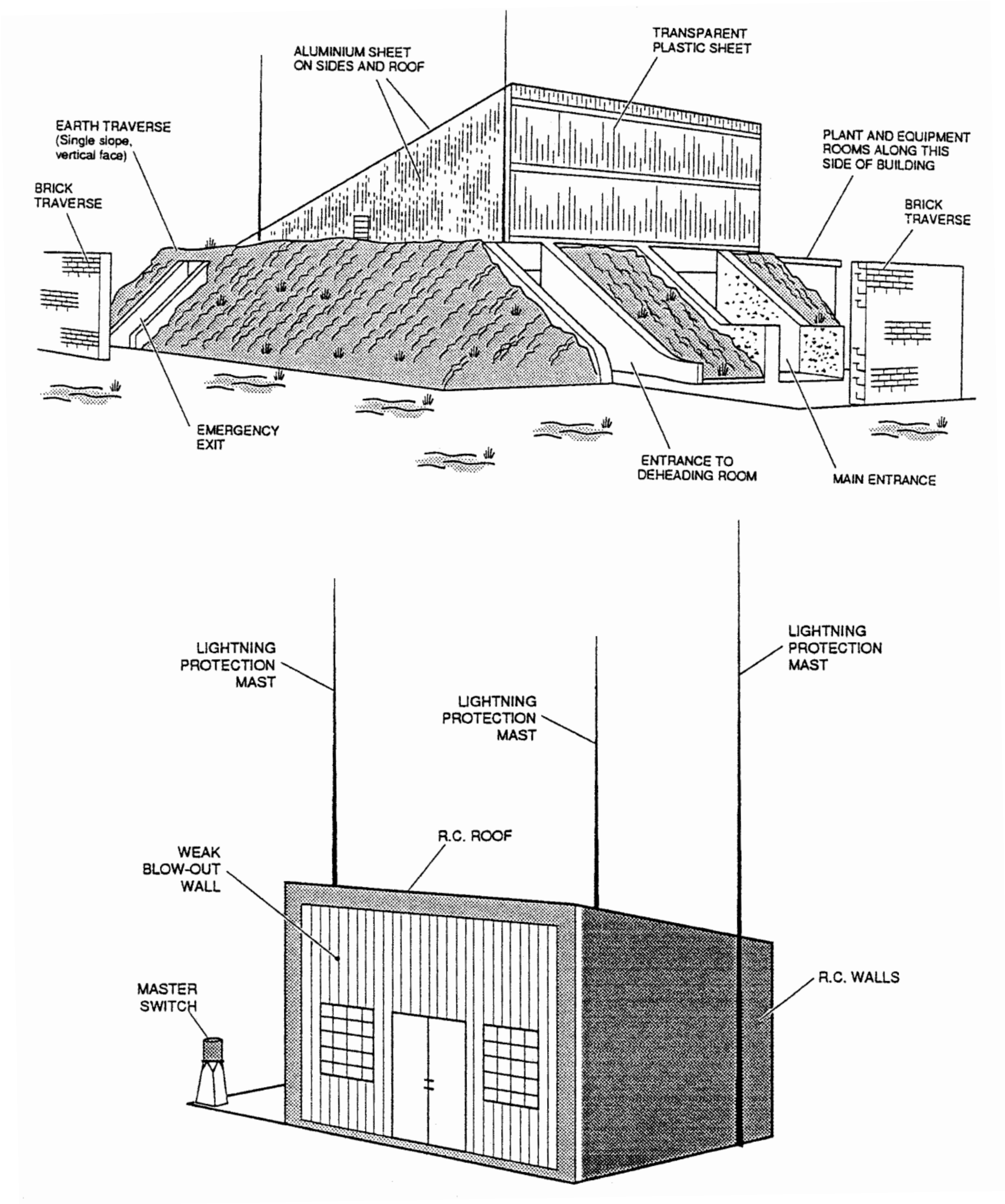


Figure 1-E-1 Design of Process Buildings in Reinforced Concrete with One Weak Wall (Based on TM5 – 1300)

ANNEX F

AIR-BLAST PARAMETERS FOR A ONE KILOGRAM TNT HEMISPHERICAL SURFACE BLAST

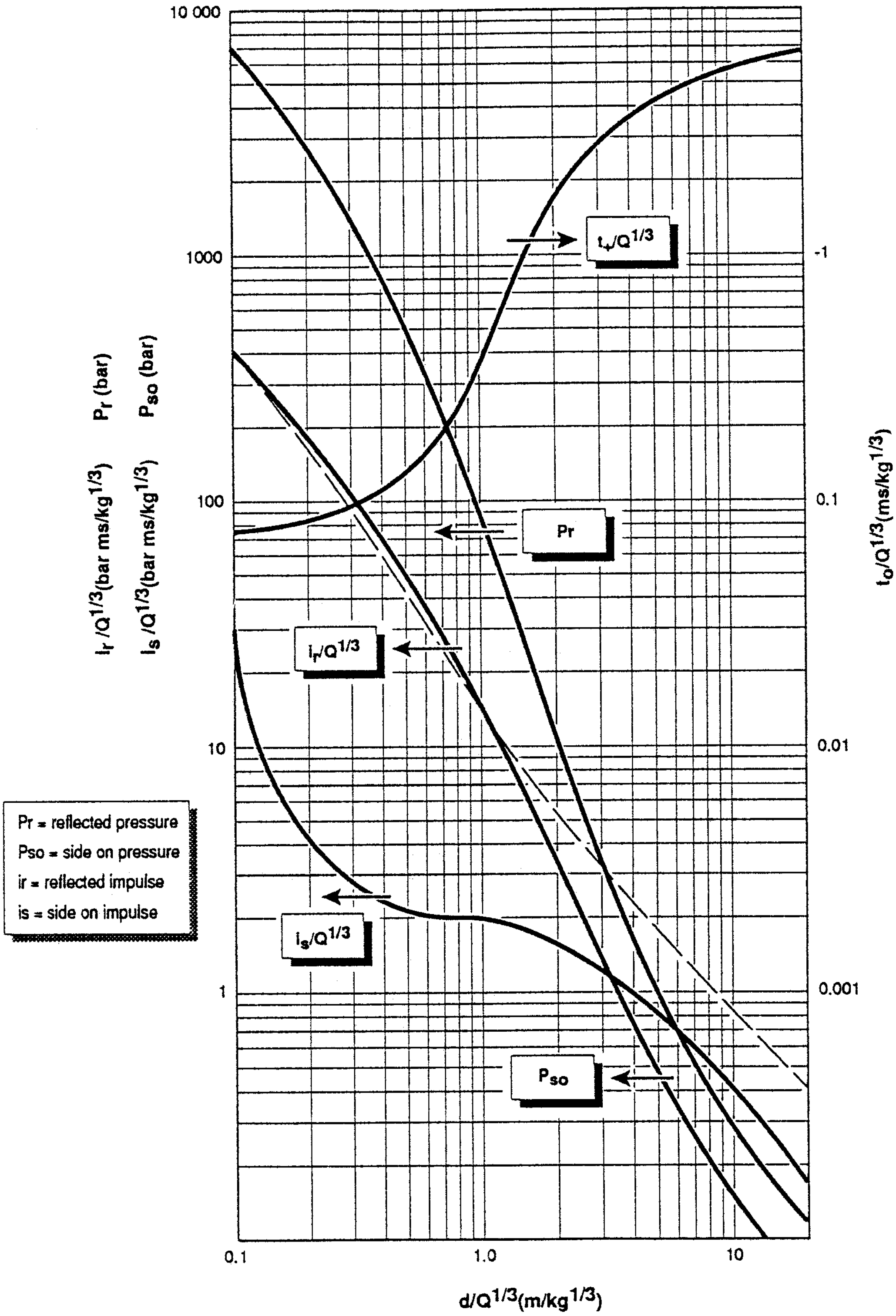


Figure 1-F-1 Airblast Parameters for One Kilogram TNT Hemispherical Surface Blast

ANNEX F

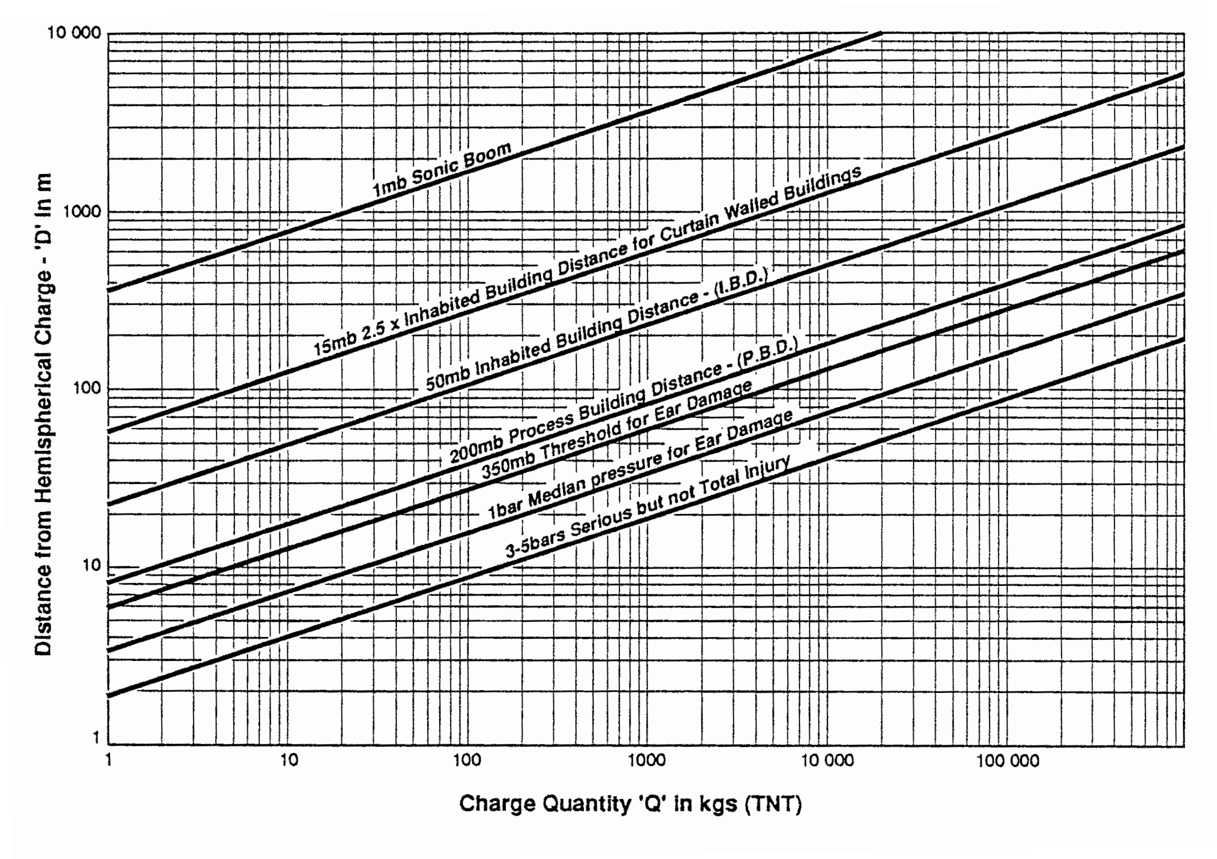


Figure 1-F-2 Airblast Parameters for a One Kilogram TNT Hemispherical Surface Blast

ANNEX G

EXPLOSIVE ORDNANCE WORKSHOPS - CONSTRUCTIONAL REQUIREMENTS

The following table summarises the requirements for building features and materials for explosive ordnance workshops, Grades A, B and C (see Regulation 4.4 Procedure 5):

Feature	Grade A	Grade B	Grade C
Floor	Concrete, surfaced with an approved gritless compound or covered with linoleum (see Note)	Concrete, surfaced hardened so as to be dust-free (see Note)	As for Grade B
Walls	230 mm brick or solid concrete blocks, faced internally with good plaster or glazed tiles	As for Grade A, but if workshops are required only for HE bombs and similar stores, expanded metal rendered internally and externally or pre-cast plaster panels	Any material which is non-flammable
Roof	Normally of light construction, but if adjacent buildings are of heavy construction, to be of concrete not less than 150 mm thick	As for Grade A	Preferably as for Grade A but any construction which is non-flammable
Internal Partition Walls	In accordance with Regulation 4.4 Procedure 5	As for Grade A	Any available
Doors	Sheet or pressed steel or hardwood	As for Grade A	Preferably as for Grade A but any type will suffice provided they open outwards
Windows	Wired obscure glass	As for Grade A	Any type
Shifting Lobby	Essential	Essential if a general purpose workshop, but not required if the laboratory is only for HE bombs and the like	Preferable, but can be improvised if required
Traverses	Essential when the workshop is within the outside quantity-distance of HD 1.1 explosives	As for Grade A	As for Grade A
Ventilation	High and low level externally controlled ventilators to be fitted except when air conditioned	As for Grade A	Preferable
Lead	To be avoided	As for Grade A	Preferably as for Grade A
Iron and Steel	Not to be exposed	As for Grade A	Preferably as for Grade A
Wood (other than Hardwood)	Not to be exposed	As for Grade A	Preferably as for Grade A
Aluminium or aluminium alloys with more than 1 per cent magnesium	Not to be exposed	As for Grade A	Preferably as for Grade A
Paint	To be lead free	As for Grade A	As for Grade A

Table 1G–1: Explosive Ordnance Workshops - Constructional Requirements

ANNEX G

NOTE

Where EED are to be inspected or tested the floors are to be of an approved conducting or anti-static material complying with the requirements of Regulation 6.3 Procedure 2. Where mains operated equipment is used, adequate protection against electric shock is to be provided by Residual Current Devices (RCD) and anti-static flooring.

ANNEX H

BLAST DATA FOR DESIGN OF IGLOOS

Origins of data

1. This section sets out, in a format that facilitates comparisons, all the blast data measured during the US ESKIMO III Trial in 1974 and the five UK model tests 1971–72. It also gives some of the data from earlier US full-scale trials on igloos 1962–63.

Tabulation of data

2. The data has been arranged in a number of tables based on the nominal scaled separation of the explosion site and the Exposed Site (ES). Table 1H–1 presents the data for a separation of 0.5 $Q^{1/3}$, table 1H–2 for 0.6 $Q^{1/3}$, table 1H–3 for 0.8 $Q^{1/3}$, table 1H–5 for 8 $Q^{1/3}$, while table 1H–4 relates to sundry observations between 1 and 2 $Q^{1/3}$.

Arrangement of data in each table

3. In each table the values have been arranged in ascending order of the scaled distance from the centre of the explosion to the gauge, rounded to two decimal places. The locations of the explosion site and the gauge are shown in column (2). These diagrams are not to scale; they show a plan view and ignore differences in elevation, for simplicity. The important variable is the orientation of the explosion site relative to the ES and the gauge. As a convention, the explosion site is always shown on the left of the diagram.

Blast parameters

4. The values of side-on and face-on blast parameters are shown in separate columns. The latter include the reflected shocks sometimes observed in the vicinity of the headwalls of the igloo at the ES, except for certain values of scaled distances in table 1H–4 (No 4–11), where the reflected values are given in a separate column. Values of positive duration and positive impulse per unit area have been scaled by dividing by the cube root of the Net Explosive Quantity (NEQ).

Validity of model testing

5. The validity of comparisons between model and full-scale igloos was established by the Arco trials of the US, 1946, and is corroborated by US and UK tests.

Rounding of values

6. All values have been rounded for simplicity in making comparisons. The experimental variations among replicate tests are such that an implied precision better than about 10 per cent would not be justified. Certain unreliable observations, such as those from gauges underneath sand cover in the UK models, have been excluded from the tables.

Symbols

7. The symbols used are as follows:

a. Igloo: plan view with headwall/door downwards.

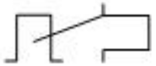
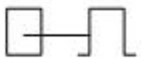
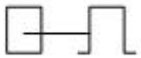
b. Foundation slab for UK Test No 5 (no explosion site).

c. Sand traverse (UK model tests).

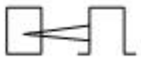
ANNEX H

In the tables 1H–1 to 1H–5, igloo A is the left igloo and igloo B is the right igloo.

ANNEX H

No	Location of gauge (scaled distance)	SIDE-ON			FACE-ON			Remarks	Q	Reference	No
		Peak overpressure	Scaled duration	Scaled impulse	Peak overpressure	Scale duration	Scaled impulse				
	m $kg^{-1/3}$	bar	ms $kg^{-1/3}$	bar ms $kg^{-1/3}$	bar	ms $kg^{-1/3}$	bar ms $kg^{-1/3}$				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	0.57 	10.3	–	–	17.2	–	–	Gauge shows initial shock and reflection from headwall. Contents of acceptor igloo detonated after 60 ms.	90 700 kg TNT in 155 mm projectiles (15% net charge).	US/DDESB 1971 Eskimo 1, East igloo, gauge flush with ground, left of door.	1
2	0.60 				18.0	0.6	4.5	Gauge on sidewall of igloo underneath the sand cover.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge 1/A	2
3	0.62 				220	0.4	16.0	Gauge on sidewall of igloo relatively exposed to the air, by partial removal of sand cover over the gauge zone (residual cover 0.16 m).	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge 1/H	3
4	0.62 	5.2	0.7	0.8				Gauge 3 m toward donor from igloo A centerline, on headwall 1.2 m from ground.	159 000 kg tritonal in 750 lbs bombs.	US/DDESB Eskimo III	4
5	0.62 	3.8	–	0.8				Gauge 3 m toward donor from igloo B centerline, on headwall 1.2 m from ground.	159 000 kg tritonal in 750 lbs bombs.	US/DDESB Eskimo III	5
6	0.68 	3.4	0.8	0.4				Gauge on igloo A centerline, in ground 0.6 m in front of door.	159 000 kg tritonal in 750 lbs bombs.	US/DDESB Eskimo III	6

ANNEX H

7	0.68 	4.5	0.8	0.5		Gauge on igloo B centerline, in ground 0.6 m in front of door.	159 000 kg tritonal in 750 lbs bombs.	US/DDESB Eskimo III	7
8	0.70 	1.7	1.2	0.4		Gauge flush with headwall, beside door.	64 kg tetryl/TNT in steel case, 20 per cent net.	UK/ESTC 1971 Test 2, gauge 1/C	8
9		2.7	1.3	1.3		Idem	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 3, gauge 1/C	9
10		2.7	0.8	0.9		idem	idem	UK/ESTC 1972 Test 4, gauge 1/C	10
11	0.72 	5.5	0.2	0.5		Gauge flush with headwall beside door.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge 1/C	11
12	0.73 	33.2	0.4	1.7		Gauge flush with roof, devoid of any sand cover.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge 1/D	12
13		35.3	0.4	1.3		idem	idem	UK/ESTC 1972 Test 5, gauge 1/E	13
14	0.73 	4.1	–	1.0		Gauge 3 m farther from donor than igloo A centerline, on headwall 1.2 m from ground.	159 000 kg tritonal in 750 lbs bombs.	US/DDESB Eskimo III	14
15	0.73 	2.8	1.0	0.8		Gauge 3 m farther from donor than igloo B centerline, on headwall 1.2 m from ground.	159 000 kg tritonal in 750 lbs bombs.	US/DDESB Eskimo III	15
16	0.75 	3.7	–	–		Gauge on outside face of door, in middle	45 400 kg RDX/TNT bulk explosive in cane.	US/ASESB 1963 Test 6, West igloo	16

17	0.75 	3.4	0.8	1.0		Gauge flush with headwall, above door.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1971 Test 1, gauge 1/B	17
18		2.2	0.6	0.5		idem	64 kg tetryl/TNT in steel cane 20 per cent net.	UK/ESTC 1971 Test 2, gauge 1/B	18
19		2.2	1.0	1.2		idem	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 3, gauge 1/B	19
20		2.0	1.1	0.8		idem	idem	UK/ESTC 1972 Test 4, gauge 1/B	20
21	0.77 	2.6	1.0	1.0		Gauge flush with ground.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 4, gauge G1.	21
22	0.77 	7.6	1.0	1.3		Gauge flush with headwall, above door.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge 1/B	22
23	0.80 	10.8	0.7	1.2		Gauge flush with ground	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge G1	23
24	0.93 	2.4				Gauge allegedly ‘normal to door’ but is assumed to record side-on overpressure only.	580 kg TNT equivalent (HE plus propellant in 3 missiles.	US/ASESB1963 Test 5, igloo C	24

Table 1H-1: Blast data for igloos at nominal scaled separation of 0.5 $Q^{1/3}$

ANNEX H

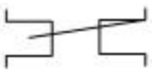
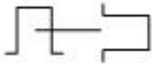
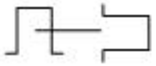
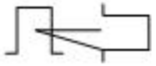
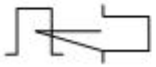
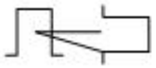
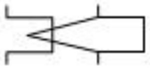
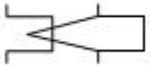
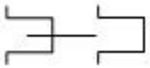
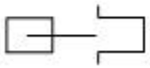
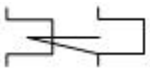
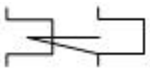
No	Location of gauge (scaled distance)	SIDE-ON			FACE-ON			Remarks	Q	Reference	No
		Peak overpressure	Scaled duration	Scaled impulse	Peak overpressure	Scale duration	Scaled impulse				
	m $kg^{-1/3}$	bar	ms $kg^{-1/3}$	bar ms $kg^{-1/3}$	bar	ms $kg^{-1/3}$	bar ms $kg^{-1/3}$				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	0.77 	2.2	1.1	0.9				Gauge flush with headwall, beside door.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1971 Test 1, gauge 2/C	1
2	0.83 	3.7	–	–				Gauge on outside face of door, in middle.	45 400 kg RDX/TNT bulk explosive in case.	US/ASESB 1963 Test 6, East igloo	2
3	0.85 	2.3	1.3	1.0				Gauge flush with headwall, above door.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1971 Test 1, gauge 2/B	3
4		1.7	0.8	0.6				idem	64 kg tetryl/TNT in steel case, 20 per cent net.	UK/ESTC 1971 Test 2, gauge 2/B	4
5	1.02 	2.5	–	–				Gauge allegedly 'normal to door' but is assumed to record side-on overpressure only.	580 kg TNT equivalent (HE plus propellant in 3 missiles).	US/ASESB 1963 Test 5, igloo B	5
6	1.03 	1.7	2.3	–				Gauge allegedly 'normal to door' but is assumed to record side-on overpressure only.	910 kg TNT equivalent in lightly cased charges.	US/ASESB 1962 Test 7, nearer door of acceptor igloo	6
7	1.60 	0.3	–	–				Gauge allegedly 'normal to door' but is assumed to record side-on overpressure only.	580 kg TNT equivalent (HE plus propellant in 3 missiles).	US/ASESB 1963 Test 5, igloo D	7

Table 1H-2: Blast data for igloos at nominal scaled separation of 0.6 $Q^{1/3}$

ANNEX H

		SIDE-ON			FACE-ON						
No	Location of gauge (scaled distance)	Peak overpressure	Scaled duration	Scaled impulse	Peak overpressure	Scale duration	Scaled impulse	**Remarks**	**Q**	**Reference**	**No**
	m $kg^{-1/3}$	bar	ms $kg^{-1/3}$	bar ms $kg^{-1/3}$	bar	ms $kg^{-1/3}$	bar ms $kg^{-1/3}$				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	0.86 	54.8	0.7	7.2				Gauge flush with ground. Headwall failed under blast load and was projected into igloo, damaging rear wall.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge G2	1
2	0.86 	5.6	0.9	1.8				Gauge flush with ground. Gauge shows initial shock and reflection from headwall.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 4, gauge G2	2
3	0.90 				6.6	0.8	1.8	Gauge flush with headwall, above door.	64 kg tetryl/TNT	UK/ESTC 1972 Test 3, gauge 2/B	3
4					6.2	0.8	2.0	Gauge flush with headwall, beside door.	idem	UK/ESTC 1972 Test 3, gauge 2/C	4
5	0.91 				168	0.8	10.7	Gauge flush with headwall, above door. Wall failed.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge 2/B	5
6					162	0.7	11.2	Gauge flush with headwall, above door. Wall failed.	idem	UK/ESTC 1972 Test 5, gauge 2/C	6
7	0.92 				5.6	0.7	1.6	Gauge flush with headwall, abovedoor.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 4, gauge 2/B	7
8					6.9	1.1	2.4	Gauge flush with headwall, beside door.	idem	UK/ESTC 1972 Test 4, gauge 2/C	8
9	0.99 	5.2	–	–	16.4	0.3	–	Gauge shows initial shock and reflection from headwall.	90 700 kg TNT in 155 mm projectiles (15 per cent net charge).	US/DDESB 1971 Eskimo I, North igloo, Right ground gauge.	9

10	1.00				5.0	0.6	1.0		90 700 kg TNT in 155 mm projectiles (15 per cent net charge).	US/DDESB 1971 Eskimo I, South igloo, gauge flush with headwall, left of door.	10
11					5.2	0.7	1.1			idem but gauge right of door	11
12	1.00	1.9	–	–	4.2	0.6	–	Gauge shows initial shock and reflection from headwall.	90 700 kg TNT in 155 mm projectiles (15% net charge).	US/DDESB 1971 Eskimo I, south igloo, left ground gauge.	12
13		2.3			4.2	0.6	–	idem	idem	US/DDESB 1971 Eskimo I, south igloo, right ground gauge.	13
14	1.00 	3.1	0.7	1.0				Gauge shows initial shock and reflection from headwall.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 4, gauge G3.	14
15	1.01 	20.6	0.9	3.7				Headwall cracked by blast load but remained in place.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge G3.	15
16	1.05				5.6	0.6	1.5	Flush gauge above door.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 3, gauge 3/B	16
17					6.9	0.8	1.2	Flush gauge beside door.	idem	UK/ESTC 1972 Test 3, gauge 3/C	17
18					2.7 (3.0)	0.7 (2.9)	1.0 (5.3)	Flush gauge above door. Two distinct pulses recorded.	idem	UK/ESTC 1972 Test 4, gauge 3/B	18
19					4.8	0.6	1.1	Flush gauge beside door.	idem	UK/ESTC 1972 Test 4, gauge 3/C	19
20	1.07				4.5	1.0	1.5	Flush gauge above door.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1971 Test 1, gauge 3/B	20
21					5.6	0.7	1.2	Flush gauge beside door.	idem	UK/ESTC 1971 Test 1, gauge 3/C	21
22					2.8	–	–	Flush gauge above door.	64 kg tetryl/TNT in steel case, 20 per cent net.	UK/ESTC 1971 Test 2, gauge 3/B	22

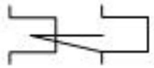
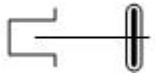
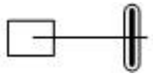
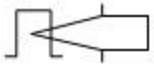
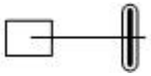
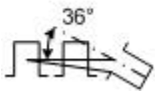
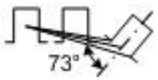
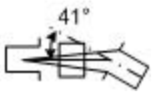
23	1.07 				54.1	0.6	4.9	Gauge flush with headwall, above door. Headwall cracked by blast, remained in place.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge 3/B	23
24					41.2	0.6	3.3	Gauge flush with headwall beside door.	idem	UK/ESTC 1972 Test 5, gauge 3/C	24
25	1.08 	6.7	0.8	1.2				Gauge flush with ground beyond sand barricade.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 4, gauge C5	25
26	1.08 	11.0	0.8	1.5				Gauge flush with ground beyond sand barricade.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge G4	26

Table 1H-3: Blast data for igloos at nominal scaled separation of 0.8 $Q^{1/3}$

ANNEX H

No	Location of gauge (scaled distance)	SIDE-ON Peak overpressure	SIDE-ON Scaled duration	SIDE-ON Scaled impulse	REFLECTED Peak overpressure	REFLECTED Scaled impulse	FACE-ON Peak overpressure	FACE-ON Scaled duration	FACE-ON Scaled impulse	**Remarks**	**Q**	**Reference**	**No**
	$m\ kg^{-1/3}$	bar	$ms\ kg^{-1/3}$	$bar\ ms\ kg^{-1/3}$	bar	$bar\ ms\ kg^{-1/3}$	bar	$ms\ kg^{-1/3}$	$bar\ ms\ kg^{-1/3}$				
(1)	(2)	(3)	(4)	(5)	(3a)	(5a)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	1.17	1.7	–	–			4.4	0.9	–	Separation of igloos—1.1 $Q^{1/3}$. Gauge shown initial shock and reflection from headwall.	90 700 kg TNT in 155 mm projectiles (15 per cent net charge.	US/DDESB 1971, Eskimo I, west igloo, left ground gauge.	1
2		2.6	–	–			4.7	0.7	–	idem	idem	US/DDESB 1971, Eskimo I, west igloo, right ground gauge.	2
3	1.20 	8.5	0.7	1.1						Beyond sand barricade. Gauge flush with ground	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge G5.	3
4	1.49 and 1.52	–	–	–	6.6	–				Gauge 3 m from igloo C centerline, on headwall 1.2 m from ground.	159 000 kg tritonal in 750 lbs bombs	US/DDESB, Eskimo III.	4
5		3.1	–	–	7.9	–				Gauge on igloo C centerline, in ground 0.6 m in front of door.	idem	US/DDESB, Eskimo III.	5
6	1.45, 1.50 and 1.58	–	–	–	5.2	1.1				Gauge 3 m from igloo D centerline, on headwall 1.2 m from ground.	idem	US/DDESB, Eskimo III.	6
7		1.7	–	–	4.8	–				Gauge in igloo D centerline, in ground 0.6 m in front of door.	idem	US/DDESB, Eskimo III.	7
8		–	–	–	5.2	0.7				Same as above off-centre gauge.	idem	US/DDESB, Eskimo III.	8
9	1.63, 1.68 and 1.75	–	–	–	11.4	2.0				Gauge 3 m from igloo E centerline, on headwall 1.2 m from ground.	idem	US/DDESB, Eskimo III.	9
10		5.2	–	–	12.4	–				Gauge in igloo E centerline, in ground 0.6 m un front of door.	idem	US/DDESB, Eskimo III.	10
11		–	–	–	10.3	1.6				Same as above off-center gauge.	idem	US/DDESB, Eskimo III.	11

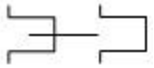
12	2.18 			0.3	2.5	0.2	Separation of igloos -1.8 $Q^{1/3}$. Gauge flush with ground. assumed to be the reflected shock from headwall.	1000 TNT equivalent, taking account of explosive type (Comp B) and GP bomb case.	US/ASESB 1962 Test 1, North-east igloo, gauge NE–1.	12

Table 1H-4: Blast data for igloos at nominal scaled separation of 1–2 $Q^{1/3}$

ANNEX H

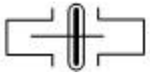
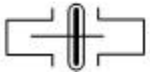
No	Location of gauge (scaled distance)	SIDE-ON			FACE-ON			Remarks	Q	Reference	No
		Peak overpressure	Scaled duration	Scaled impulse	Peak overpressure	Scaled duration	Scaled impulse				
	$m\ kg^{-1/3}$	bar	$ms\ kg^{-1/3}$	$bar\ ms\ kg^{-1/3}$	bar	$ms\ kg^{-1/3}$	$bar\ ms\ kg^{-1/3}$				
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1	8.13 	0.3	3.6	0.3				Gauge beyond sand barricade flush with ground. Gauge show initial shock and reflection from headwall.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 4, gauge G9.	1
2	8.15 	0.6	3.4	0.4				Gauge beyond sand barricade flush with ground. Gauge shows initial shock and reflection from headwall.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge G9.	2
3	8.25 				0.2	2.3	0.2	Gauge flush with headwall, above door.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 4, gauge 4/B.	3
4					0.2	2.7	0.3	Gauge flush with headwall, beside door.	idem	UK/ESTC 1972 Test 4, gauge 4/C.	4
5	8.27 				0.5	3.0	0.4	Gauge flush with headwall, above door.	64 kg tetryl/TNT uncased charge.	UK/ESTC 1972 Test 5, gauge 4/B.	5
6					0.6	2.8	0.4	Gauge flush with headwall, beside door.	idem	UK/ESTC 1972 Test 5, gauge 4/C.	6

Table 1H-5: Blast data for igloos at nominal scaled separation of 8 $Q^{1/3}$

PROCEDURE 2 - TRAVERSES

INTRODUCTION

Purpose

2.1 This instruction describes the functions, classifications, design and construction of traverses and the manner in which traversing is used to protect personnel from injury, property from damage, other Explosive Ordnance (EO) from damage or propagated explosion, or to contain or reduce the effects of an accidental explosion of EO.

2.2 Agencies responsible for the detailed design of EO facilities and traverses are to be conversant with the contents of Ministry of Defence (UK) Publication JSP 482 *MOD Explosive Regulations, Chapter 6 and 7 – Buildings and Traverses for Military Explosives*, US Forces US Forces Unified Facilities Criteria (UFC) UFC 3-340-02 – *Structures to Resist the Effects of Accidental Explosions,* and Regulation 6.1 Procedure 1.

General

2.3 Properly constructed artificial traverses and natural terrain of similar dimensions are effective means for protecting EO, structures or operations, so that reductions can be made in EO quantity distances. In planning explosives storage facilities maximum safety and flexibility of use can be achieved by traversing all buildings.

2.4 The design criteria for a traverse depends on its location and whether it is required to contain, intercept or act as a receptor of explosive effects, or a combination of these functions.

FUNCTIONS OF TRAVERSES

Interception of High Velocity Projections

2.5 A traverse is a barrier whose primary function is to intercept low angle, high velocity projections from an explosion in a Potential Explosion Sites (PES) which otherwise may cause practically instantaneous propagation of the explosion to EO at an Exposed Site (ES). The traverse must therefore have sufficient resistance to high velocity projections to reduce their speed to a tolerable level. The geometry of the traverse in relation to the PES and ES is such that it intercepts the projections through a sufficiently solid angle to prevent hazardous impingement on the ES. When the traverse is subject to destruction by blast from the PES, it is designed to remain substantially intact for a time sufficient to achieve its purpose.

2.6 An effective traverse also reduces the number of high velocity projections which otherwise may endanger personnel and ES both inside and outside the EO area, but this is usually a secondary function.

Interception of Lobbed Explosive Ordnance and Fragments

2.7 An effective traverse may also intercept some lobbed items of EO and lobbed fragments but this is an incidental benefit. It is not usually practical to intercept items projected at high elevation.

Modification of Blast and Flame

2.8 A traverse at a PES may induce directional effects to the blast and flame of an explosion or it may merely perturb them. This is a secondary function of a traverse, unless it is especially designed to achieve one or more of these purposes.

2.9 A traverse between a PES and an ES may shield the ES from blast and flame. In order to have a marked shielding effect, the traverse needs to be located close to the ES (approx 0.6 to 1 m).

CLASSIFICATION OF TRAVERSE TYPES

2.10 Traditionally, traverses have been classified into four functional types according to the nature of the protection they give. It is not always possible to distinguish clearly between traverse types as their functions tend to merge according to their position relative to the PES or ES. However, it is still considered that the classification by function is useful because it indicates a measure of the traverse strength required. The types of traverses are as follows:

a. **Receptor Traverse.** The function of a receptor traverse is to protect EO within the building it surrounds from direct attack by low angle, high velocity projections from a near-by explosion. It can be used for storage units where the EO quantities are too large for an interceptor traverse to be effective. A receptor traverse should be as close as possible to the building it is protecting.

b. **Interceptor Traverse.** The function of an interceptor traverse is to protect EO positioned outside such a traverse from direct attack by low angle, high velocity projections from an explosion within. The traverse can be undermined by the crater and destroyed by the blast loading, but it must remain in position long enough to intercept and slow down the projections before it collapses. It must be massive to be effective and hence may be uneconomic for large quantities of EO.

c. **Container Traverse.** The function of a container traverse is to contain the high velocity projections from an explosion within its confines. It protects personnel, buildings or stacks in the vicinity from the effects of an internal explosion, and therefore must remain substantially intact after an explosion. This is practicable only for small quantities of EO of Hazard Division (HD) 1.1 (less than 1 000 kg Net Explosives Quantity (NEQ)) and therefore may be useable only around certain process buildings.

d. **Screening Traverse.** The function of a screening traverse is to protect inhabited buildings from high velocity projections. If it is located at the PES, to be effective it must be high enough to intercept all fragments projected at 40º or less, and remain substantially intact after an explosion. It is seldom used except in the special case where an isolated inhabited building needs such protection. Annex A describes the design, geometry, construction and use of Screening Traverses.

Building and Traverse Combination

2.11 The choice between receptor traverses and interceptor traverses for buildings containing HD 1.1 EO is influenced by the NEQ of EO the buildings are intended to hold, the number of such buildings and their position relative to buildings containing EO of other hazard divisions. When the number of buildings containing HD 1.1 EO is small and the number containing other HD directly exposed to the projection hazard from HD 1.1 EO is large, it may be economical to provide interceptor traverses for the few HD 1.1 storage buildings since this will avoid the need to provide receptor traverses for each of the other storage buildings.

2.12 In the Quantity Distance Tables of Regulation 5.4, only the combination of an interceptor traverse and a light frangible structure is given as a PES. The traverse gives substantial benefits when the ES is also a light frangible building. It does not affect other types very much as they are considered to have an integral interceptor or receptor traverse because of their walls or earth cover. At an ES, the receptor/container traverse is combined with a process building in addition to the light frangible building. If the process building has heavy walls it can also be considered traversed and hence, in general, separate traverses are only used with light frangible structures.

2.13 Except where a special screening traverse is used, a traverse has little effect on the Inhabited Building Distance. It is most useful when combined with a process building to enable quantity distances to be reduced and by careful design, personnel to be given more protection.

2.14 Internal interceptor or receptor traverses may be provided within an EO storehouse when propagation of an explosion between individual stacks is to be avoided. Such construction is normally only required when adjacent stacks are of an exceptional nature or when quantity distance considerations are such that the hazard from the explosion of the total contents of a building must be reduced.

Effective Traversing

2.15 An effective traverse is one sited as close as possible to the building, and constructed of materials, dimensions and geometry detailed in these instructions.

2.16 A bunker type building, semi-underground building or a building the ceiling of which is below the natural ground level, may be considered as effectively traversed provided the ground cover is at least 2.4 m thick at the height of the stack of EO and at least 1.5 m thick at a height 600 mm above the stack of EO. The entrances to such buildings are, when necessary, to be protected by traverses.

2.17 Where there is intervening high ground between two untraversed EO buildings, the buildings may be considered to be effectively traversed from each other provided the crest of the high ground is at least 1.5 m above every line joining the top surfaces of the stacks of EO in the buildings.

2.18 When there are both traversed and untraversed EO buildings within the EO area, the untraversed buildings containing HD 1.1, 1.2 and 1.3 EO may be considered to be effectively traversed provided they are completely screened from each other by intervening traversed buildings, or the traverses provided are of the interceptor type.

2.19 Any EO building with less protection than that detailed in paragraphs 2.15 to 2.18 inclusive, is to be considered as untraversed.

TRAVERSE DESIGN CONSIDERATIONS

Traverse Types

2.20 The functions of a receptor, interceptor, container and screening traverses have been described in paragraph 2.10. The six standard types of traverses are shown, with their explosives HD 1.1 limits, in Annex B and are described below:

a. **Type I.** Double slope earth mound.

b. **Type II.** Single slope vertical face earth mound (or partial vertical face mound).

c. **Type III.** Steep double slope earth mound or ‘Chilver’ type.

d. **Type IV.** ‘Bunker’ building or ‘combined’ traverse. This includes fully buried buildings not more than 600 mm below ground level.

e. **Type V.** Wall traverses of brick, reinforced concrete (RC), earth sandwiched between concrete or steel.

f. **Type VI.** Natural features of site, eg hillocks. These would be similar in geometry to Type I at a minimum size.

2.21 Types I, II and III comprising sloping traverses, are the most commonly used for storage purposes as they can function in all four protective roles: receptor, interceptor, container and screening. A Type IV traverse makes use of the building structure to support the earth cover and is described in Regulation 5.4 and will not be discussed further in this chapter. A Type V wall traverse is used primarily as a receptor traverse or, if properly designed, as a container traverse.

Traverse Geometry

2.22 Proper traverse geometry is necessary to reduce the risk of high velocity projections escaping over or around the ends of the traverse and so causing damage or an explosion in an adjacent site. Since such projections do not move along perfectly linear trajectories, reasonable margins in traverse height and length must be provided beyond the minimum dimensions that block lines of sight. The dimensions of traverses are determined in the manner described in paragraphs 2.23 to 2.26 inclusive.

2.23 The limiting dimensions for the earth traverses can be controlled by a 2º rule that is shown in Annex C. This does not apply for distances greater than $5Q^{1/3}$, where Q is the NEQ in kg, or, where the terrain is sloping and stacks are not contiguous for distances of less than $5Q^{1/3}$. When stacks, whether contiguous or not, are separated by distances $5Q^{1/3}$ or greater, traverses are assessed individually.

2.24 An alternative to the 2º rule would be to maintain a minimum traverse width of 2.4 m at the level of the top of the EO stack, or if this is variable, the eaves of the building which the traverse protects. The traverse should project an additional 600 mm minimum above whichever level is relevant.

2.25 The traverse length is determined by extending the traverse, exclusive of the end slope, to 1 m beyond lines between the extremes of the two stacks of EO under consideration. These lines must pass through at least 2.4 m of traverse materials or undisturbed natural earth, see Figure 2-1.

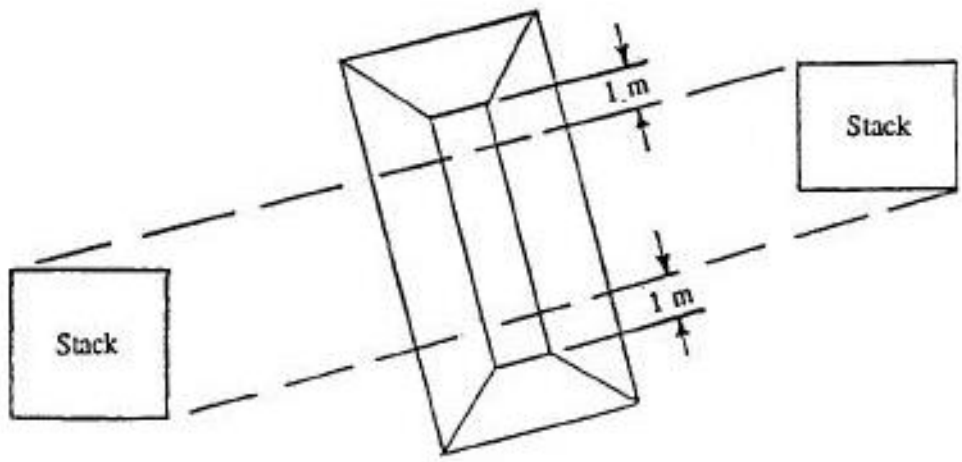


Figure 2-1 Determination of Traverse Length

2.26 **Distance from stack to traverse.** The distance from a stack to the foot of a traverse is a compromise. Each case is considered individually to achieve the optimum solution taking account of the following factors:

a. A traverse close to a stack results in smaller dimensions for the traverse to intercept high velocity projections through a given solid angle. However, on sloping terrain the minimum separation may not result in the smallest traverse.

b. A traverse further away from the stack results in easier access for maintenance and for vehicles, and the possibility to site the traverse outside the predicted crater, when the PES contains EO of HD 1.1. Avoidance of the crater is an advantage in some circumstances, *see* paragraph 2.30. The traverse must be sited so that the crater does not undermine it more than on third of its thickness at ground level.

2.27 **Position of Traverses.** In general, a traverse should be placed as close as practicable to the EO stack it protects in order to give maximum shielding from high velocity projections and also to obtain the minimum height. The traverse toe or face should be positioned about 1 m from the stack or the EO storehouse wall. However, access for maintenance and vehicles may require a larger separation distance that will result in the need for a higher traverse. In addition, where a traverse may be undermined by the crater or the NEQ exceeds 75 000 kg, the traverse should be moved outwards so as to avoid undermining. Alternatively, the traverse thickness can be increased in proportion to the quantity of explosives so that at least 2/3 of its base width is outside the crater. An approximate estimate of the crater diameter (D) in metres can be calculated from the formula, $D = Q^{1/3}$, with Q in kg, ie twice the D3 distances in Table 1 of Regulation 5.4 Annex A. For a more accurate prediction of crater size, the depth of burst and the soil or other material type in which the crater is formed, must be taken into account.

Material for Earth Traverses and for the Cover of Buildings

2.28 When concrete or brick is used in conjunction with earth, either of these materials may be taken as equivalent to four times its thickness of earth with regard to the ability to stop fragments. The concrete or brick may be used to support the earth or it may be those parts of the roof and walls of a building which intercept the high velocity projections.

2.29 There are two types of precaution which are necessary in the construction of earth traverses or the earth-cover for buildings used for storage of EO. One type relates to the potential hazards to other EO and to personnel in the event that the material is dispersed by an accidental explosion in the contained building. The other type relates to the precautions necessary to ensure the structural integrity of the earth traverses or cover.

2.30 There is no need to consider the first type of precaution if it can be predicted that the material would not be dispersed by the postulated explosion. This will be the case if the traverse is sited beyond the crater radius. Scouring of the top surface by air blast can be neglected. The crater dimensions would be determined by the geometry of the stored EO, their height above-ground or depth of burial, and the nature of the ground. Unless the arrangement is particularly symmetrical, a good working estimate of the crater radius can be calculated from the formula:

Crater radius (m) = $\frac{1}{2} Q^{1/3}$

(or table 1A-1, column D3 of Regulation 5.4)

Where Q = net explosives quantity (NEQ) in kg

This radius is measured from the centre of the EO. In certain soil conditions (saturated soil or clay) the crater may be larger than calculated from the formula (more complete information on cratering phenomenology is given in the Guidance Section, Pamphlet 8 – Ground Shock, Cratering and Ejecta Hazards). In such conditions consideration should be given to increasing the inter-magazine distances.

2.31 Where it is possible that the material would be dispersed by an explosion, precautions should be taken to reduce the hazard of large stones causing initiation by impact upon EO in adjacent storage sites. Where the storage site under construction is near a densely occupied area, such as a group of EO workshops, consideration should be given to the hazard to personnel from flying stones, etc. The selection of material and its use should be governed by the following prescriptions which represent a reasonable compromise between undue hazards and excessive costs of construction:

a. Do not deliberately use rubble from demolished buildings.

b. Ensure that stones and similar potential missiles larger than 300 mm girth are removed during construction.

c. In climates where ground becomes severely frozen, consideration should be given to the provision of an impermeable cover over the material or drainage to keep out excessive moisture.

2.32 Where a traverse is unlikely to be dispersed by an explosion, no special materials are required in its construction. However, it would be prudent to use one of the above specifications to provide a degree of flexibility for storage purposes. Earth for covering buildings and igloos should be to one of the above specifications. The design slope will depend on the properties of the fill, see Table 2-1.

Material Description	Grading Limits			Design Slope (dependant upon fine material content)
	Coarse Material		Fine Material Content (Max % by Weight)	
	Maximum Particle Size	Coarse Material Content (Max % by Weight) (20-75 mm)		
Well Graded Sand	6.3 mm	-	15%	1:1.5-1:2.0 (33º-26º)
Well Graded Gravelly or Clayey or Silty Sand (inorganic)	75 mm	10%	25%	1:1.3-1:2.0 (37º-26º)
Inorganic Fill	75 mm	-	20% clay content	1:2.0-1:2.5 (26º-21º)

Table 2-1 Grading Limits for Materials used for Earth Traverses

Notes:

1. Fines-particle size less than 63 µm
Clay-particle size less than 2 µm

2. Well-graded sand or well-graded gravelly or clayey or silty sand should have a Uniformity Coefficient (D_{60}/D_{10}) of 6 or greater.

3. Design slopes tabulated are indicative only and will depend on many factors such as:

   a. The nature and strength of foundation soils/rocks and depth to water table;

   b. The degree of compaction and surface preparation provided to the fill;

   c. The fines content and erodability potential of the fill materials;

   d. The compaction moisture content where the fill materials are non-free draining;

   e. The provision of drainage measures to control short/long term pore pressures; and

   f. Whether the fill is reinforced with geosynthetics, steel strips, steel wire mesh etc.

   Accordingly, the stability of the slope should be checked on a case by case basis. The required factor of safety against rotational slip will depend on the function of the traverse, consequences of failure to the safe use of the facility and the degree of disruption caused while repairs are being carried out if failure occurs. However, the factor of safety should not be less than 1.2 in the long term.

4. In the case of a reinforced fill slope, information from the reinforcement manufacturer would be required to determine number and type of reinforcement, embedded lengths and vertical spacing. Therefore the manufacturer's early involvement in the design process should be sought. Where a vertical or near vertical (>70º) face using wrap-around detail or precast concrete facing element is envisaged for the reinforced fill, the material should be free-draining and must comply with the requirements of the manufacturer of the reinforcement. Since such a configuration constitutes a 'wall', the factor of safety against sliding should not be less than 2 and that against rotational slip not less than 1.5.

5. Measures should be taken to prevent the burrowing of rabbits into the traverse. Light wire mesh should be built into the traverse at suitable locations.

Other Traverse Materials

2.33 When brick, concrete or steel is used to support the vertical face of a Type II or III traverse the effectiveness of these materials in stopping high velocity projections compared with earth can be taken as 4, 6 and 24 times respectively. The traverse thickness may be reduced accordingly but the equivalent mass of an interceptor traverse should not be reduced below that of 2.4 m of earth at the level of the top of the stack or eaves, to stop dispersion of the traverse occurring.

Erosion of Earth Traverses

2.34 The problem of earth traverse erosion is one that should ideally be addressed during the planning and construction of traverses, in preference to the necessity of providing remedial action at a later stage. It must be borne in mind that, particularly in the case of interceptor traverses which may be destroyed by an explosion at a PES, any method used to counter erosion must not result in the creation of additional fragmentary debris during an explosion.

2.35 The following methods are therefore suitable for countering erosion on earth-fill traverses:

a. polymer stabilising agents;

b. ‘Enviromat’ or similar products;

c. bitumenous sprays;

d. cement sprays (which will effectively be pulverised by blast, as opposed to concrete, which will fragment); and

e. grass.

Wall Traverses

2.36 **Walls as traverses.** Walls can be utilised as traverses as long as they comply with the following criteria:

a. **External walls of buildings.** A building without windows and with walls with a thickness of 450 mm reinforced concrete (700 mm of brick), or its equivalent, is acceptable as a traversed building with regard to stopping fragments from an explosion in an adjacent building or stacks. However, consideration must be given to the necessary blast resistance of such walls. Furthermore, account should be taken of the increased debris hazard such walls at a PES. A 230 mm brick wall protected by a 450 mm brick wall is preferable to a single wall of about 700 mm brick. These buildings need not necessarily have a protected roof.

b. **Dividing walls within buildings.** Walls can often be used to divide a building into individual rooms or compartments in accordance with Regulation 5.4. The function of each dividing wall is to prevent, or at least to delay substantially, transmission of explosion between EO on opposite sides of the wall. The main advantage is that QD can then be based on the NEQ in one compartment instead of the aggregate amount in the building. A second advantage is that an accidental explosion is likely to render unserviceable all the stocks in the building. The specification of such a wall depends upon the quantity, proximity and type of EO on each side. The design must take into account the likely blast loading, including the effects of reflections, and the flame, ground shock, primary fragments and secondary missiles (spalling and scabbing from the remote face of the wall). In order to achieve and efficient and economical design for a particular situation, expert advice is essential. Information on the scope and state of the art of designing dividing walls is given in the technical manual – *Structures to Resist the Effects of Accidental Explosions*, Department of Defence ARLCD-SP-84001, (previously United States Army TM5-1300, June 1969).

2.37 **Internal Walls of Buildings and Traverses.** The overall explosive effect of the contents of an EO storehouse is reduced by providing walled compartments containing small quantities of the EO.

This is especially important for process buildings where the walls may be required to act as container traverses and protect personnel. Annex D gives guidance on the thickness of RC walls suitable for this purpose. For relatively small charges, often used in process buildings, Table 2-2 gives the thickness required for cantilever container traverses of 3m maximum height and 1m stand-off from the charge, in order to prevent collapse.

Charge Weight	RC Wall Thickness, Buttressed at 3m centres, 0.2% tension reinforcement	Nominal Brick Wall Thickness
(kg)	**(mm)**	**(mm)**
2.5	225	340
5	225	340
7	225	450
12	225	570
18	300	680
35	450	
50	600	
68	750	

Table 2–2: Wall Thickness v Charge Weight

Air Blast Effects on Personnel Behind a Traverse

2.38 The RC wall traverses shown in Annex D may be considered to act as container traverses and protect personnel outside them from an explosion within their confines, up to a limit of 1 000 kg. Types I, II and III earth traverses can be considered to have a limit of 1 100 kg for personnel protection. For explosive quantities greater than 68 kg, where a cantilever wall traverse is used, or pressure leakage is likely, the expected blast pressure at the personnel position can be determined from Annex E. The free field blast pressure at the personnel position should be used with no reduction for the shielding effect of the traverse. Pressure will be reduced in the lee of the traverse but if it is required to take this into account a specialist should be consulted and tests carried out to justify any reductions being taken.

2.39 The table 2-3 gives an indication of the blast pressures at which personnel injury levels will occur.

Injury Level	Maximum Blast Pressure (kPa)	Maximum Blast Pressure (psi)
Eardrum Rupture		
Threshold	35	5
50%	100	15
Lung Damage		
Threshold	70	10
50% lethality	250	36
Body Translation		
Threshold of lethality	100-150	15-22
50% lethality	400-750	58-110

Table 2–3: Blast Overpressure v Personnel Injury Level

Effects of Traversing on Quantity Distance Tables

2.40 The effects of traversing and door barricades on the application of the Quantity Distances Tables are detailed in Regulation 5.4.

Annexes:

A. Screening Traverse - 40 Degree Rule
B. Types of Traverses
C. 2 Degree Rule for Traverse Dimensions
D. RC Wall Traverses to Resist Explosion
E. Determination of Free Field Blast Pressures

ANNEX A

SCREENING TRAVERSE - 40 DEGREE RULE

1. This Annex describes the design, geometry, construction and use of Screening Traverses.

General

2. A screening traverse is a form of container traverse that, by virtue of its size will, effectively screen an ES from an accidental explosion within the PES confines. Its function is primarily to protect personnel. Since it must remain substantially intact after an explosion, this form of traversing is practicable for only small quantities of EO. As most projections must be stopped, it must be very tall.

3. A screening traverse may be used for process buildings but is seldom used except in the special case where an isolated inhabited facility needs virtually complete protection.

Traverse Geometry

4. The construction characteristics of a screening traverse are detailed in paragraph 5 and described diagrammatically in the figure at Appendix 1.

5. The following characteristics describe screening traverse requirements:

a. The inner wall of the traverse is to be vertical faced.

b. The inner face is not to be more than 1 m from the EO facility.

c. The traverse is to be of sufficient height so that a line drawn at 40º from the horizontal passes through the traverse, with a minimum thickness/width of traverse at that point of 1 m (see figure at Appendix 1). The 40º line is measured from the centre of the top of the explosives stack if the roof is lightweight and from the centre of the roof if it is not lightweight construction.

d. The thickness of the traverse at a level equal to the maximum possible stacking height of the PES is to be not less than 2.4 m.

Effects of Screening Traverse on Outside Quantity Distances

6. Research indicates that for Outside Quantity Distances (OQD) traversing has little significance when large NEQ are involved. However, a screening traverse, in some instances, may cancel the fixed minimum OQD requirements for EO of HD 1.1 and 1.2, subject to the conditions prescribed in paragraph 7.

7. A screening traverse, of dimensions and geometry described in paragraphs 4 and 5 is capable of containing an explosion up to a NEQ of 1000 kg for HD 1.1 or 1.2. For these conditions, the OQD criteria specified in Regulation 5.4 Annex A Table 1 may be used for EO of HD 1.1, with no fixed minimum distances applying. For NEQ greater than 1 000 kg, a screening traverse has little effect and the normal OQD is to be observed, with fixed minimum distances applying.

8. The use of screening traverses is described by the example in Appendix 2.

Appendices:
1. Screening Traverse - 40 Degree Rule
2. Example - Use of Screening Traverse

**APPENDIX 1 TO
ANNEX A**

SCREENING TRAVERSE - 40 DEGREE RULE

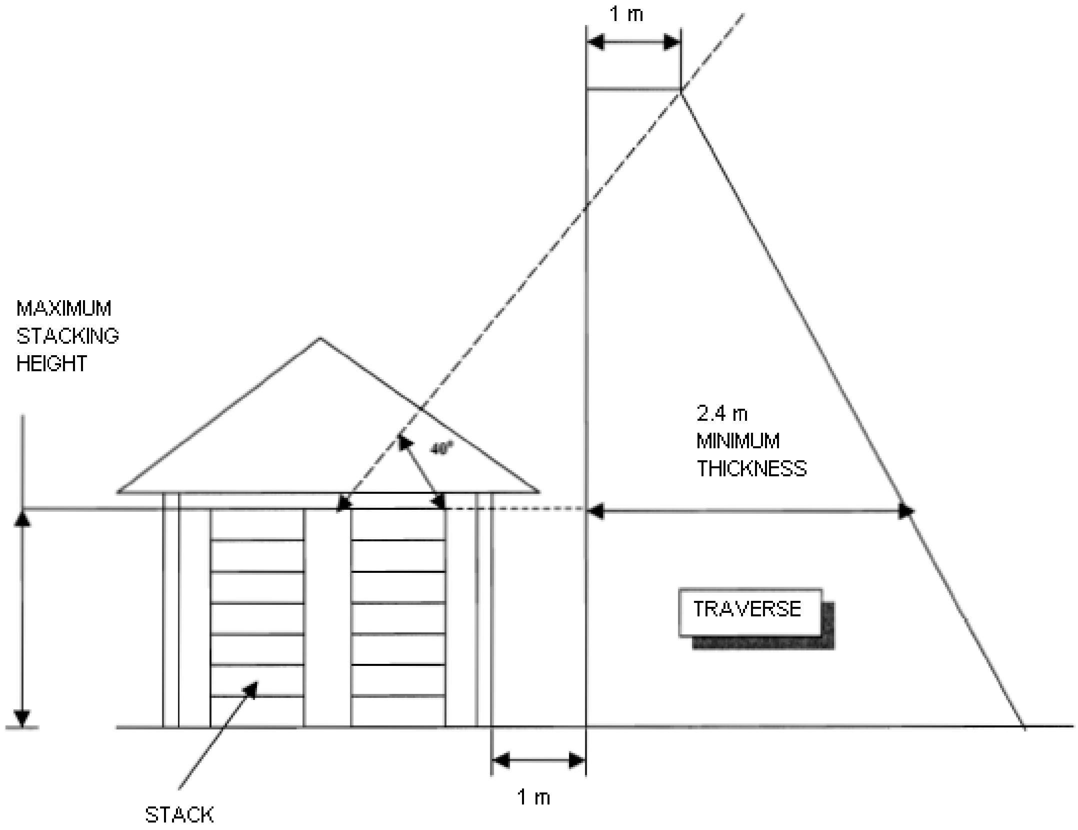


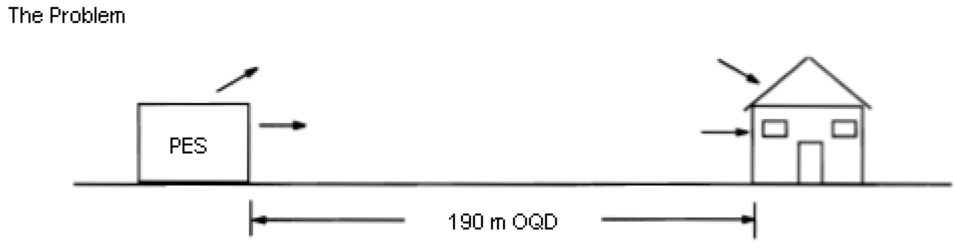
Figure 2-A-1-1 Screening Traverse – 40 Degree Rule

Note

1. For details on traverse geometry see Annex A, paragraph 5.

**APPENDIX 2 TO
ANNEX A**

EXAMPLE - USE OF SCREENING TRAVERSE



1. An establishment has a quantity of HD 1.1 explosive ordnance which is being considered for storage in the above PES which is located 190 m from an isolated inhabited building. However, reference to the Q-D table (see Regulation 5.4) for HD 1.1 shows that a fixed minimum distance of D13 (270 m) is required; this means that HD 1.1 cannot normally be stored in this PES. The PES is untraversed in relation to the inhabited (Group IV) facility.

Finding a Solution

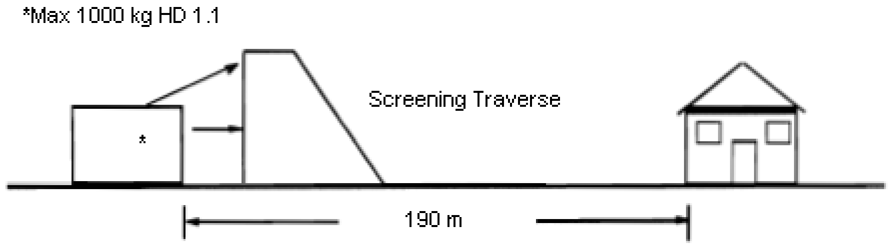
2. By building a screening traverse (40º rule) the fixed minimum distance is cancelled (see Annex A) subject however to the condition that a screening traverse will only be effective in containing a NEQ of 1 000 kg or less of HD 1.1.

NOTE

In the above considerations, it is incorrect to apply the D13 scale in Q-D Table 1 (see Regulation 5.4) for in so doing it would appear that for a distance of 190 m a NEQ of 1 400 kg could be stored.

The Solution

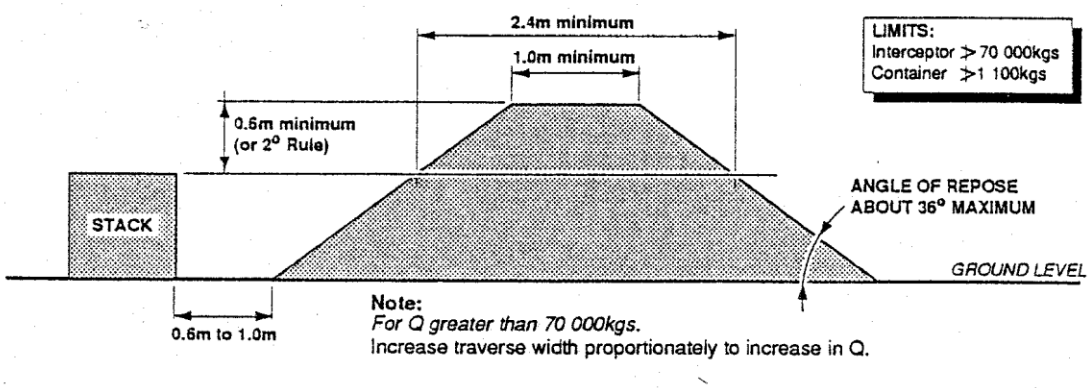
3. In the event that a screening traverse is erected at the PES, a maximum of 1 000 kg NEQ of HD 1.1 can be stored therein.



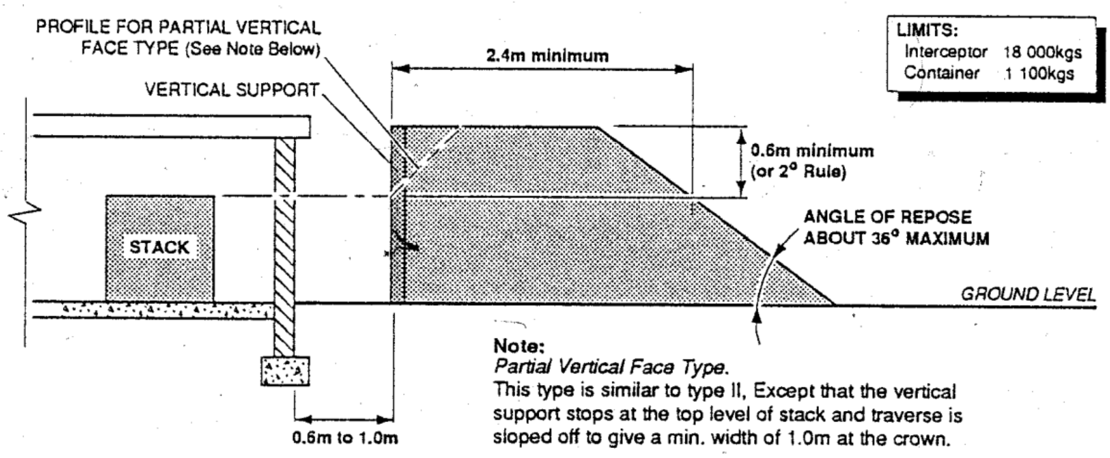
ANNEX B

TYPES OF TRAVERSES

TYPE I. STANDARD DOUBLE SLOPE



TYPE II. SINGLE SLOPE VERTICAL FACE



TYPE III. STEEP DOUBLE SLOPE

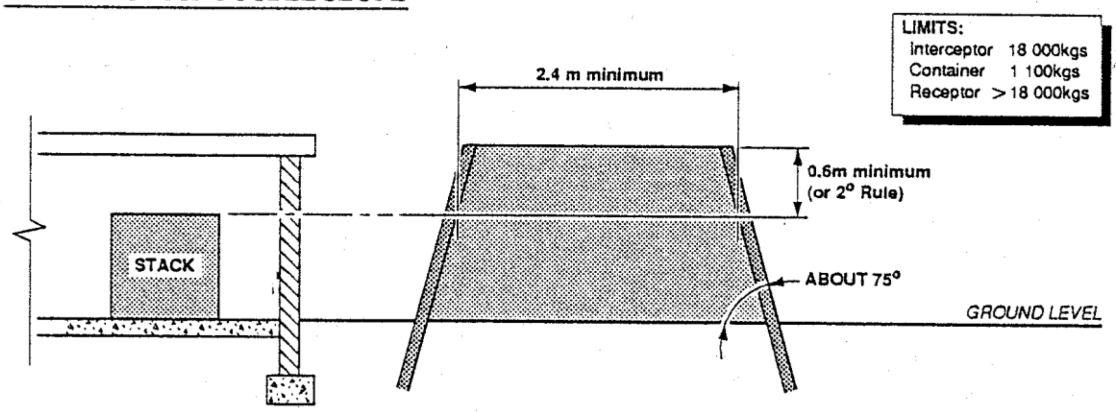
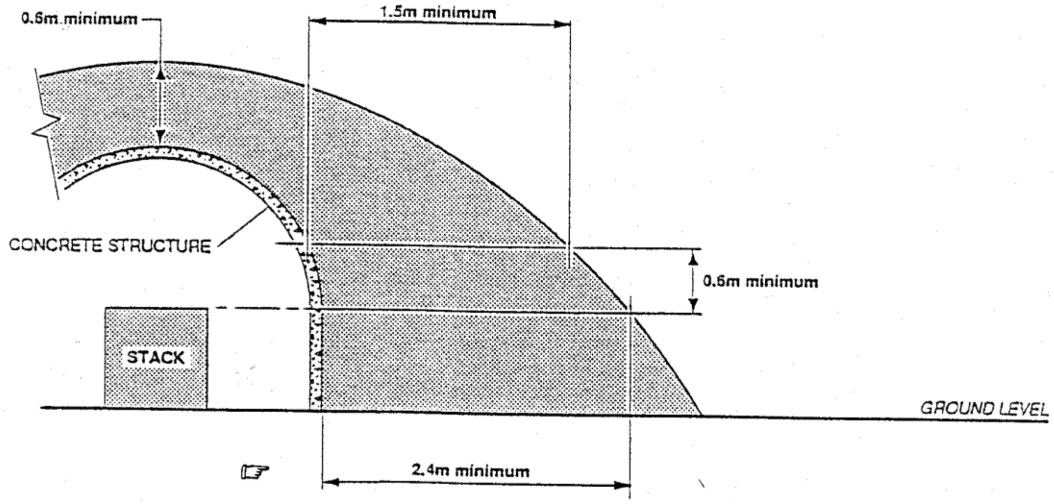
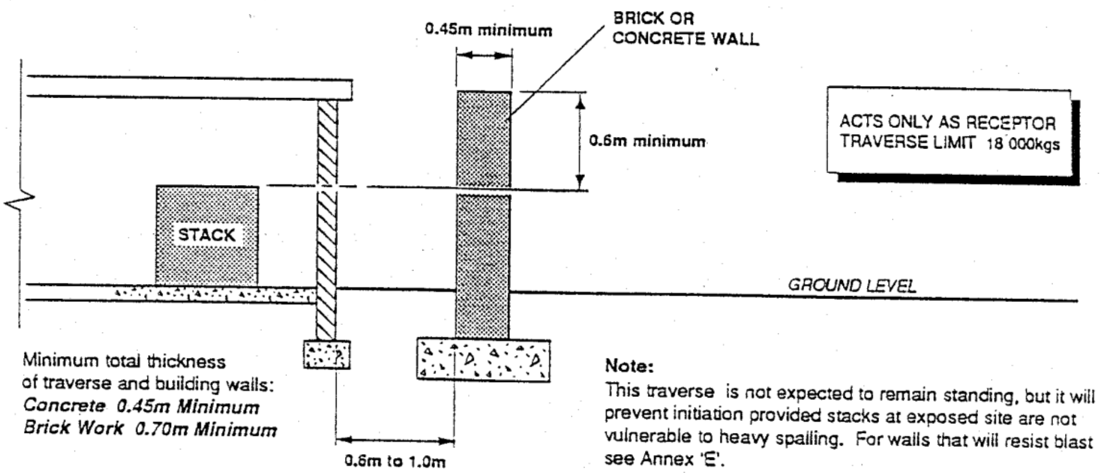


Figure 2-B-1 Types of Traverses

TYPE IV. BUNKER BUILDING OR BELOW GROUND



TYPE V. WALL TRAVERSE



TYPE VI. NATURAL MOUNDS ETC.

NATURALLY OCCURING FEATURES ON THE GROUND MAY BE USED AS TRAVERSES, PROVIDING THAT THE DIMENSIONAL LIMITATION STATED FOR TYPE I ARE COMPLIED WITH.

Figure 2-B-2 Types of Traverses

ANNEX C

2 DEGREE RULE FOR TRAVERSE DIMENSIONS

1. **Height of traverse.** The following points must be applied when calculating the required height of the traverse using the 2º rule.

2. **Line AB:**

a. **Refer figure 2C–1.** On level terrain, point A is chosen as a reference on either of two stacks. If the stacks have different heights, Point A is on the lower stack. Point A is at the top of that face of the chosen stack which is remote from the other stack. If the stacks are covered by protective roofs, Point A may be at the top of that face of the other stack which is nearer to the other stack. Point B is on the top face of the other stack.

b. **Refer figure 2C–2.** On sloping terrain, point A is on the stack whose top face is at the lower elevation. Point A is at the top of that face of the chosen stack which is remote from the other stack. If the stacks are covered by protective roofs, point A may be at the top of that face of the chosen stack which is nearer to the other stack. Point B is on the top face of the other stack.

c. Line AB must pass through at least 2.4 m of traverse material or undisturbed natural earth between the two stacks, whether or not they are contiguous.

3. **Line AC (2° rule):**

a. Point A is chosen in accordance with paragraph 2.

b. On level or sloping terrain a second line (AC) is drawn at an angle of 2° above line AB.

c. On level terrain, when stacks are separated by less than 5 $Q^{1/3}$, whether or not they are contiguous, line AC must pass through at least 1.0 m of traverse material or undisturbed natural earth.

d. On sloping terrain when the stacks are contiguous, line AC must pass through at least 1.0 m of traverse material or undisturbed natural earth.

e. On sloping terrain when two stacks are not contiguous but the Quantity Distance (QD) between them is less than 5.0 $Q^{1/3}$, the 2° rule is not applicable.

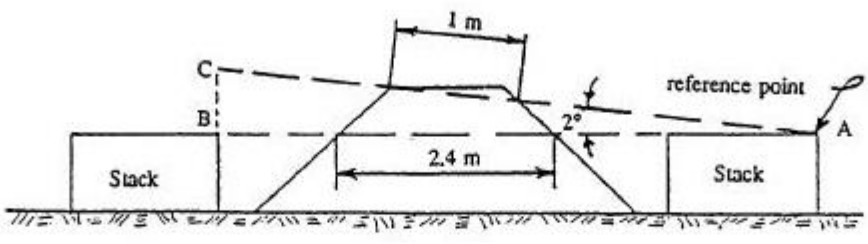


Figure 2-C-1 Determination of Traverse Height on Level Terrain

ANNEX C

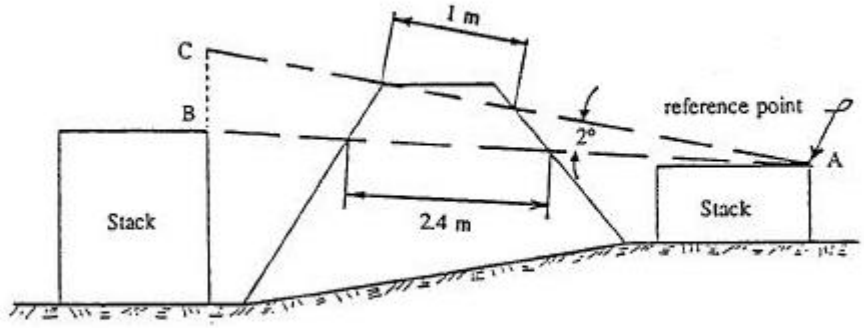


Figure 2-C-2 Determination of Traverse Height on Sloping Terrain

ANNEX D

RC WALL TRAVERSES TO RESIST EXPLOSION

Notes:

1. Curves show RC wall thickness/Charge weight in kg T.N.T. equivalent for ‘Stand Offs’ from 0-5 metres in the open. Minor spalling can be expected, wall rotations > 4”.

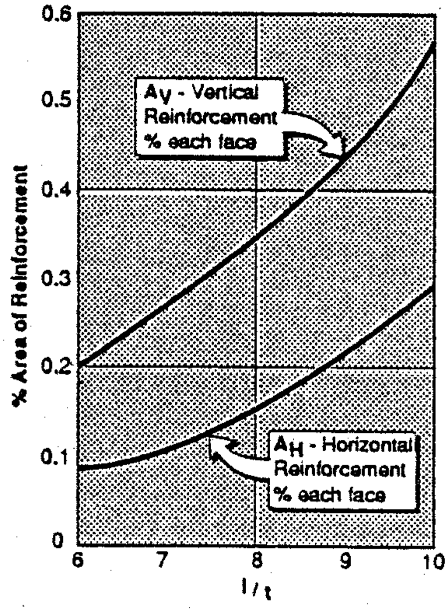
2. Wall panels can be considered as supported to top, base and sides or simply supported l/t > 10.

3. Concrete to be grade C = 30 N/mm^2 cube strength at 28 days age.

4. Reinforcement hot rolled High Tensile Bars minimum A_V 0.2% X-X area vert each face and A_H 0.1% X-X area horizontal each face for l/t ≤6; see figure for l/t ratios >6≤10.

5. For cantilever RC walls, use double the thickness ‘t’ given from the graph and double % area of vertical reinforcement placed in the face nearest to charge.

6. Thicknesses given do not take account of fragment penetration. Where this is likely ‘t’ min < 600 mm for reasonable protection.



Ref TM5-855-1 *Fundamentals of Protective Design Fig. 39, Curve 2.*

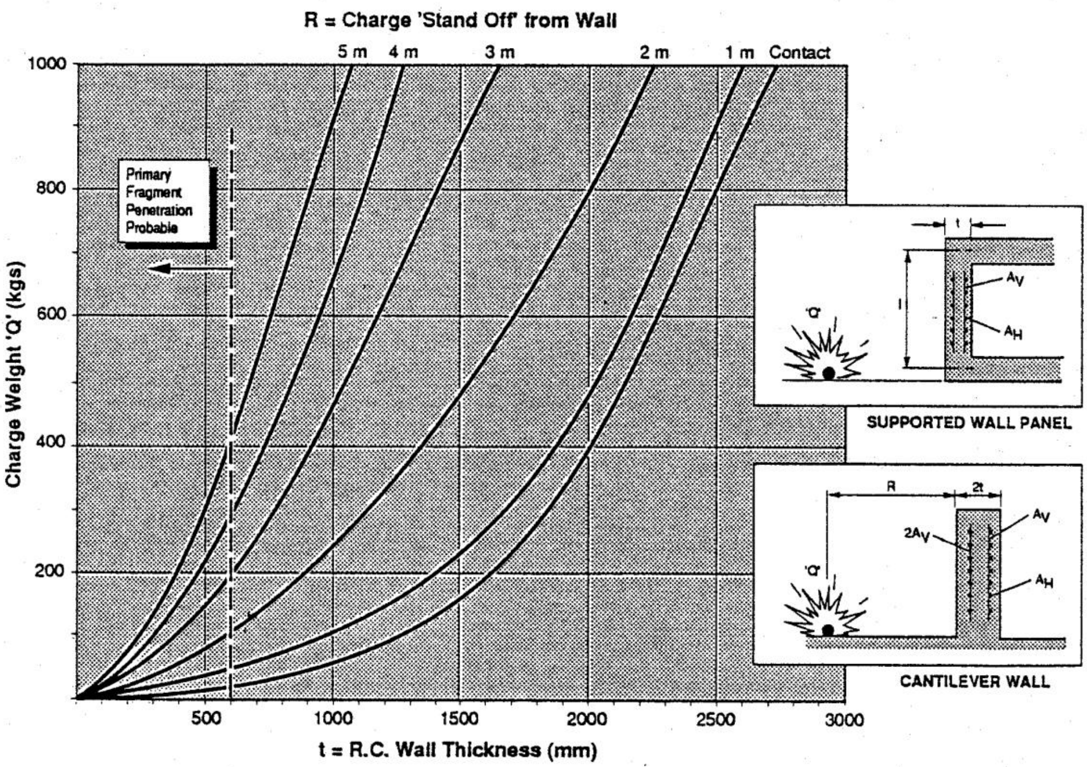


Figure 2-D-1 RC Wall Traverses to Resist Explosion

ANNEX E

DETERMINATION OF FREE FIELD BLAST PRESSURES

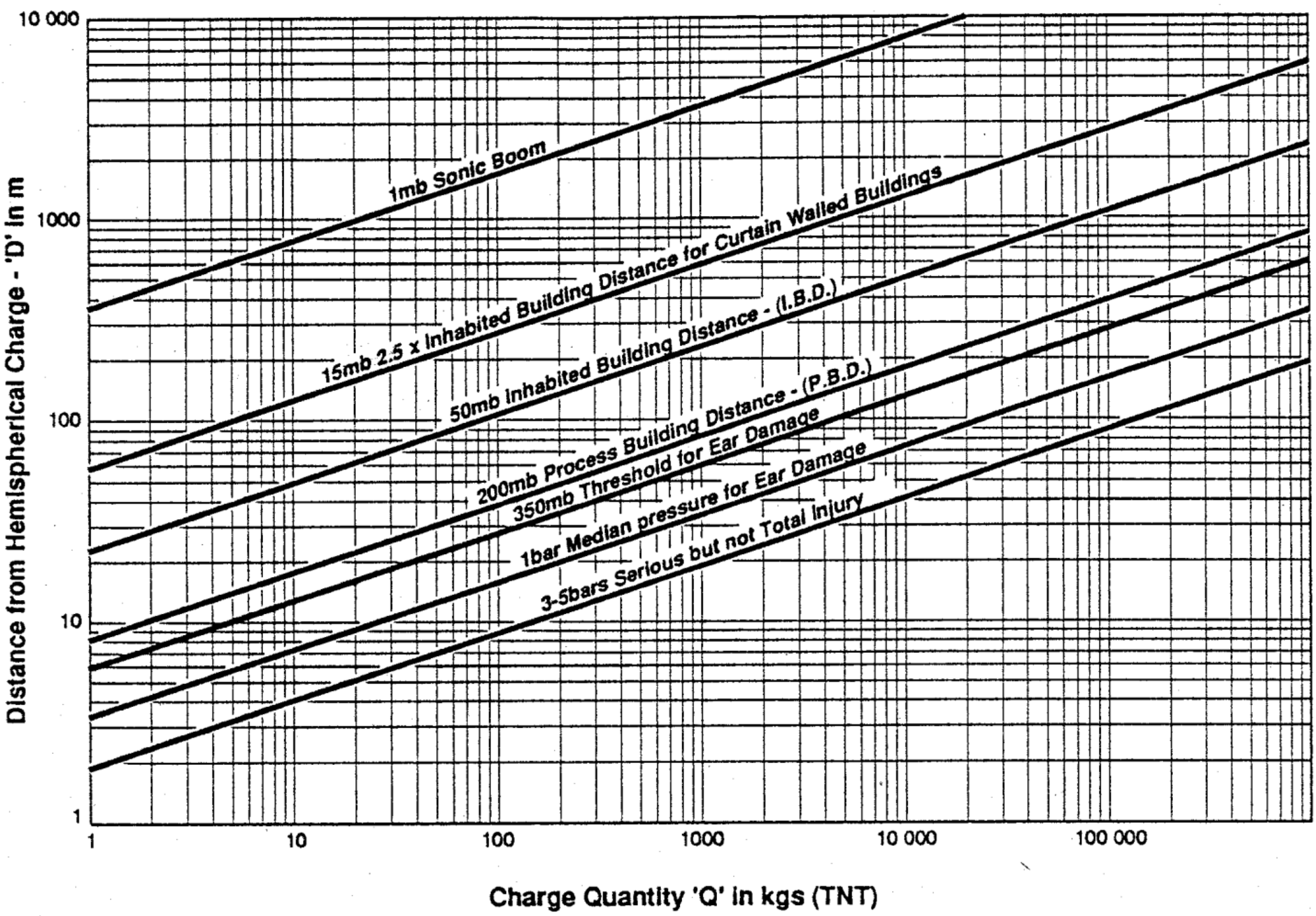


Figure 2-E-1 Determination of Free Field Blast Pressures

PROCEDURE 3 - CALCULATION OF STORAGE CAPACITY AND SPACE REQUIREMENTS

Purpose

3.1 This procedure describes the methods for calculating the storage capacity and floor space requirements for Explosive Ordnance (EO) facilities.

General Considerations

3.2 The floor space requirements for the storage of EO will depend on the maximum stacking heights permitted for the stores in question (see Regulation 4.1 Procedures 8 and 9), or the height obtainable if this is less, and the size of the packages or items.

3.3 As it is necessary to allow for gangways, working space, short stacks, etc, only a proportion of the total cubic capacity of a storage facility may be taken as the effective capacity for the storage of EO. The effective capacity is normally to be assessed as half the floor area of the storage facility multiplied by the height of the stacks. Alternatively, accurate calculations may be undertaken if the types of stores and their packaging arrangements are known.

3.4 Although the effective capacity of a storage facility is the factor most likely to limit the amount of EO that can be accommodated, it is also governed by the hazard division and the net explosives quantity of the items to be stored in the facility, the available quantity-distance and whether or not the facility is traversed. When considering these additional factors reference is to be made to the following:

a. Regulation 6.1 Procedure 2 – Traverses.

b. Regulation 5.4 Annex A - Quantity-Distance for Above-ground Storage.

c. Regulation 4.4 Procedure 2 - Explosive Ordnance Storage Facilities

d. Regulation 4.4 Procedure 5 - Explosive Ordnance Workshops.

e. Regulation 4.4 Procedure 7 - Explosive Ordnance Preparation Facilities.

f. Regulation 2.1 Procedure 1 - Classification of Explosive Ordnance for Storage, Handling and Transport.

g. Topic -025 of the item publication.

Method for Calculating the Storage Capacity of an Explosive Ordnance Facility

3.5 The limiting factors to be considered when calculating the quantity of EO that a facility can store are:

a. The limit imposed by the effective capacity of the facility (see paragraph 3.3).

b. The limit imposed by the explosives quantity permitted by the Inside Quantity Distance to other storage facilities.

c. The limit imposed by the explosives quantity permitted by the Inside Quantity Distance to Process Buildings (if applicable).

d. The limit imposed by the explosives quantity permitted by the Outside Quantity Distances.

3.6 When calculating the maximum amount of EO that a facility may contain, four figures will emerge as a result of the factors specified at paragraphs 3.5a, b, c, and d. The least of these four figures is to be taken as the maximum explosives capacity of the facility, and for licensing purposes will become the 'Explosives Limit' for the facility.

Method for Calculating Space Requirements

3.7 The floor area, in square metres which will be occupied by a given quantity of packages, is found from the formula:

$$\text{Area} = \frac{m \times w \times l}{n}$$

where **m** is the total number of packages;

n is the number of tiers of packages;

w is the width, in metres, of the package; and

l is the length, in metres, of the package.

3.8 The floor area, in square metres, which will be occupied by a given quantity of unpackaged stores is found from the formula:

$$\text{Area} = \frac{(2m + n2 - n) \times d \times l}{2n}$$

where m is the total number of items to be stacked;

n is the number of tiers of items;

d is the overall diameter, in metres, of the item; and

l is its overall length in metres.

3.9 In order to calculate the number of tiers that will not exceed the permitted stacking height, the following formula should be used:

$$\text{Number of Tiers} = \frac{h - d}{d \times 0.865} + 1$$

where **h** is the maximum permitted stacking height in metres; and

d is the maximum diameter, in metres, of the items to be stacked.

Where the calculation results in other than a whole number, the fraction is to be ignored.

Packaging Data for Calculating Space Requirements – Packaged and Unpackaged Explosive Ordnance

3.10 Packaging data for calculating floor space requirements for all EO is contained in Topic - 025.

Annex:
A. Method for Calculating Maximum Net Explosive Quantity

ANNEX A

METHOD FOR CALCULATING MAXIMUM NET EXPLOSIVE QUANTITY

1. The limiting factors to be considered when calculating the maximum quantity of explosive, in each hazard division (HD 1.4 excluded), that a facility may be permitted to accommodate are:

a. The limit imposed on the explosive quantity by the outside quantity-distances,

b. The limit imposed on the explosive quantity by the inside quantity-distances, and

c. The limit imposed by the effective capacity of the facility and the types of stores intended for storage in the facility.

2. The maximum explosive quantity permitted, in each hazard division, resulting from the factors specified in paragraph 1a and 1b, can be calculated from the Quantity-Distance Tables in Regulation 5.4 Annex A.

3. The maximum explosive quantities, in each hazard division, resulting from the factors specified in paragraph 1c are to be calculated in the manner described in paragraph 5. The quantities calculated will be hypothetical but represent the highest explosives quantity ever likely to be stored in a large quantity facility storing palletised explosives. This is achieved by choosing, for each hazard division, a practically representative explosives density factor which is to be applied to the storage volume available in the facility in question.

4. The representative explosive Density Factor (DF) for each main hazard division is:

a. HD 1.1 – 800 kg/m^3.

b. HD 1.2 – 200 kg/m^3.

c. HD 1.3 – 400 kg/m^3.

NOTE

The same density factor applies to the hazard subdivisions, i.e. 200 kg/m^3 applies to both HD 1.2.1 and HD 1.2.2 and 400 kg/m^3 applies to HD 1.3.3 and HD 1.3.4.

5. For each hazard division, the net explosive quantity achievable for a given usable floor area is found from the formula:

$$NEQ = \frac{A}{2} \times Hs \times Df$$

Where A is the usable floor area in square metres, Hs is the maximum stack height in metres and Df is the appropriate explosives density factor for the hazard division under consideration.

6. The maximum explosive capacity of a facility, for each hazard division, is the least of the figures which emerge from the calculations at paragraphs 2 and 4 above.

REGULATION 6.2 - LIGHTNING PROTECTION

General Overview

2.1 An effective lightning protection system is part of the overall safety concept for the handling of Explosive Ordnance (EO).

Requirements

2.2 Effective lightning protection measures are to be taken for Potential Explosion Sites (PES) used for the manufacture, processing, handling, or storing of EO.

2.3 **General.** The following general requirements are to be incorporated into the design of a lightning protection system:

a. Lightning protection systems must be designed and constructed in a way which ensures effective and long-term protection of EO against lightning discharge. Accordingly, it is essential that any system and the means of fixing it should be effective, simple, rugged, accessible and permanent. This applies particularly to earth termination networks which are hidden from view.

b. Lightning protection systems must be constructed by specialist personnel and according to the state-of-the-art of lightning protection technology.

c. The principle of protection, against the effects of lightning discharges, is to provide a conducting path between the atmosphere above a structure and the general mass of the earth so that the discharge can pass to earth with the minimum risk to the structure, its contents and occupants.

d. Lightning protection systems for EO facilities are to be selected and installed in accordance with this regulation and the latest revision of the Australian/New Zealand Standard (AN/NZS) 1768-2007-*Lightning Protection*. In the event of any inconsistency between AS/NZS 1768-2007 and this regulation the more rigorous requirement shall take precedence

2.4 **Initial testing of lightning protection systems**. Each lightning protection system must be inspected and tested upon completion by a competent works officer on the Board of Officers responsible for acceptance of the facility and the results recorded. The established values for the earth resistance are to be used as comparative values for future tests.

2.5 **Ongoing testing of lightning protection systems**. The proper condition of the lightning protection system is to be ensured by regular inspection and measurements in accordance with AS/NZS 1768-2007, Appendix B.

Responsibilities

2.6 All personnel involved with the planning, design, acceptance, and maintenance of EO facilities are to ensure compliance with these regulations and their associated procedures.

2.7 The licensing authority responsible for licensing the facility is to determine whether the EO facility requires lightning protection.

2.8 **Testing on completion of new works or modification responsibilities.** A competent works officer on the Board of Officers responsible for acceptance of the facility and the results recorded.

2.9 **Routine testing responsibilities.** The Officer-in-Charge (OIC) of the user organisation is responsible for reviewing the results of the (annual) routine tests. Additionally, the user organisation is responsible for the inspection where alterations or extensions to an existing LPS have been made.

2.10 The user organisation is responsible to maintain comprehensive records on the LPS of such facilities.

Procedures

2.11 The procedure used to implement the requirement of this regulation is Procedure 1 – Protection of Potential Explosion Sites against Lightning Strikes.

PROCEDURE 1 - PROTECTION OF POTENTIAL EXPLOSION SITES AGAINST LIGHTNING STRIKES

Introduction

1.1 Effective lightning protection measures must be taken for Potential Explosion Sites (PES) used for the manufacture, processing, handling, or storing of Explosive Ordnance (EO). Similar protection may be required for non-explosive buildings or other structures close to PES, i.e. up to 50 m, if a lightning strike on that structure could endanger the PES by projectile or fire hazard.

1.2 Lightning presents a hazard to EO in a number of ways, principally:

a. The energy of the voltage drop created by a lightning attachment could initiate some EO directly.

b. The surface flashover or arching of the generated current between conductive surfaces that are not at equipotential could initiate EO directly by heat, sparks, and/or by any molten metal created by the arc.

c. The same arcing could cause fires in electrical circuits and equipment.

d. The lightning could initiate fires involving combustible materials in facilities.

e. Spalling generated by the heat of the current flowing through the structural components of the facility could initiate, by impact, unprotected exposed explosives and items of EO.

1.3 Adverse lightning effects can be caused not only by direct strike/attachment, but also by indirect means such as a direct strike anywhere on a conductive penetration of the structure/facility.

Purpose

1.4 This procedure specifies the requirements for lightning protection of PES and other structures that require particular attention.

Selection and installation of lightning protection systems

1.5 Lightning Protection Systems (LPS) for EO facilities and other structures are to be selected and installed in accordance with the requirements of this procedure and the Australian/New Zealand Standard AS/NZS 1768 *Lightning Protection.*

1.6 **Assessment of the need for lightning protection.** As a general rule, lightning protection should be provided during the design and construction of all new PES and other structures requiring such protection as it is usually less expensive to install a LPS during construction than afterwards. There may be certain situations involving either new construction or existing facilities where installation of lightning protection systems is unwarranted. When making a determination as to whether lightning protection should be installed, consideration should be given to all of the following:

a. Does the structure itself afford sufficient protection without further installation?

b. Is the EO properly sited so that an explosion will not endanger exposed sites?

c. Does the frequency of electrical storms, e.g. five or more per year, justify the installation?

d. Are people physically located in the structure with the EO?

e. Can the loss of the EO be tolerated?

f. In case of an existing structure, does the value of the structure and contents warrant the cost of installation?

Facilities requiring lightning protection systems

1.7 The Licensing Authority responsible for licensing the facility is to determine whether the EO facility requires lightning protection. This determination is to be made in accordance with the risk assessment procedure in Section 2 of AS/NZS 1768, and in consultation with authorised representatives of the owner and user organisations of the facility when they are not one and the same. The decision to provide lightning protection may be taken without carrying out a risk assessment or regardless of the outcome of any risk assessment, for example, where there is a desire that there be no avoidable risk.

1.8 **Exclusions.** The installation of dedicated LPS may be omitted for the following:

a. Earth covered buildings, with more than 600 mm of earth cover, used for the storage of EO in its approved containers and where structural steel and reinforcing bars are bonded to earth. Ventilation stacks and all metallic penetrations are to be bonded to earth, and all electrical circuits are to be protected by transient over-voltage and over-current barrier devices (see also paragraph 1.9).

b. Buildings which are licensed and authorised under the conditions of Regulation 4.4 Procedure 13 unless:

(1) The possible loss of the building and the EO contained therein is unacceptable; or

(2) As a result of damage by lightning, the building would pose a serious risk to adjacent essential installations.

c. Buildings containing only HD 1.4 small arms ammunition in approved containers, or other EO that cannot be ignited by lightning or its indirect effects.

d. Steel ISO or similar containers used for the storage of EO, that have earth bonded panel and floors. The ISO containers should have at least two earthing points at opposite corners connected to driven earth electrodes. The DC resistance to earth at any point of the ISO container shall be less than 10 ohms, with earth electrodes connected.

1.9 Normally, an underground storage site does not require a system of protection against lightning, except for any exposed or almost exposed parts. Metal and structural parts of the site which have less than 600 mm earth coverage are to be protected as for an aboveground site. Each underground storage site is to be considered individually to take account of possible conducting faults in the cover.

1.10 **Lightning protection for explosive ordnance stored in the open**. The following information must be considered when storing EO in the open:

a. EO stacked in the open for a week or more should be provided with a properly installed and tested, lightning protection system using vertical (maximum 20 m high providing 30º cone of protection), or suspended air termination; unless it can be shown that an explosives event due to lightning strike is unlikely.

b. EO stacked in the open for a shorter period may be provided with a temporary vertical, or suspended, air termination lightning protection system if deemed necessary by an explosive safety advisor. The suspended air terminal system should consist of a zinc coated steel rope 50 mm^2 cross section or a copper rope of at least 35 mm^2 in cross section which is to be supported by two supports made of wood or metal.

c. ISO containers loaded with packaged EO may be stored in the open without specific lightning protection subject to the following recommendations:

(1) The ISO containers are of all welded construction or those where the frame and all panels are electrically bonded using heavy duty bonding straps;

(2) At least two earthing points are provided on each container at diametrically opposite corners;

(3) Each container earthing point is to be connected to a separate earth electrode;

(4) The DC resistance to earth at any point of the ISO container shall be less than 10 ohms, with earth electrodes connected; and

(5) ISO containers used to store EO are not stacked.

Inspections

1.11 Where a LPS has been fitted to a new facility, a competent works officer on the Board of Officers responsible for the acceptance of the facility (Regulation 5.1 Procedure 1) is to be inspect the LPS in order to verify that it is in accordance with the requirements of this instruction and AS/NZS 1768. However, the user organisation is responsible for the inspection where alterations or extensions to an existing LPS have been made. During the inspection, if there are any doubts as to the electrical continuity of the LPS, an immediate test as required by paragraph 1.12 is to be made.

Testing on completion of new works or modifications

1.12 On the completion of the installation or any modification to the LPS, the Officer-in –Charge (OIC) of the user organisation is to arrange for the resistance to earth of the whole system and each earth electrode to be measured. The electrical continuity and mechanical condition of all conductors, bonds and joints of the LPS is to be verified also. The various methods of testing are outlined in AS/NZS 1768.

1.13 The testing required by paragraph 1.12 is to be repeated at least every 10 to 14 month. These tests should be conducted in conjunction with other periodical electrical tests to anti-static protection systems and electrical installations in EO buildings (see Regulation 6.3 Procedures 1 and 2). Testing intervals are to be chosen so tests are conducted at varying seasons of the year.

1.14 **'Test Due' dates.** The date when the next test is due for the LPS installed to the building is to be marked as required in Regulation 6.3 Procedure 1.

Arranging for testing

1.15 The OIC of the user organisation of EO facilities is responsible for arranging the routine testing of LPS.

Reporting of test results

1.16 The results of continuity test of LPS are to be reported as follows:

a. **On completion of new works or modifications.** The results of the tests, carried out in accordance with paragraph 1.12, are to be made available to the Acceptance Board (of Officers) in order to assist the works officer in the inspection specified in paragraph 1.11. In addition, the test results are to be attached to the Acceptance Report for the facility, and a copy is to be retained by the facility manager, for future reference.

b. **Routine tests.** The OIC of the user organisation is responsible for reviewing the results of the (annual) routine tests. If the resistance to earth reading of a LPS, or any section of it, exceeds the lowest value obtained at initial testing (see paragraph 1.12) by more than 100%, or if the reading is significantly higher than the previous reading yet still less than twice the initial test reading, the OIC is to take immediate action to ascertain the cause (see AS/NZS 1768 Appendix C) and arrange for the correction of defects which may have arisen.

Records

1.17 The user organisation is to maintain comprehensive records on the LPS of such facilities. These records are to include the following:

a. Scale drawings showing the nature and position of all component parts of the LPS;

b. The nature of the soil and any special earthing arrangements;

c. Date and particulars of salting, if required;

d. Test conditions and results; and

e. Alterations, additions or repairs to the LPS.

Explosives Storage Stacks and Racking

1.18 EO and packaging containing EO must be stored so as to prevent flash over of the lightning stroke from the lightning protection system to the EO or the packaging.

a. EO stacks in a magazine or an EO workshop must not be positioned within 500mm[1] of external walls, ceilings, any metallic building structure and electrical installations,

b. Where metal racking is installed, it must not be positioned within 500mm of external walls, ceilings, any metallic building structure and electrical installations, and

c. Metal racking is to be connected at its base to the facility earth system. An additional fortuitous connection to a conductive/anti-static floor is acceptable. The racking is not to be connected to earth above its base.

[1] It is not necessary to apply the 500 mm stand-off distance in the case of small arms ammunition of HD 1.4 classification in its approved packaging.

REGULATION 6.3 - ELECTRICAL STANDARDS

General Overview

3.1 This regulation provides the policy for electrical installations, electrical/electronic equipment, including Vehicles and Mechanical Handling Equipment (MHE) and for the protection of Explosive Ordnance (EO) from electrical hazards in above ground and underground sites containing, or likely to contain explosive ordnance. This regulation does not apply to electrical installations where explosives are manufactured.

Requirements

3.2 These requirements are to be read in conjunction with other Regulations, Australian Standards and Codes of Practice referenced by this document.

3.3 In addition to this regulation and its associated procedures, specific requirements for electrical installations are contained in Manual of Infrastructure Engineering – Electrical (MIEE).

General Requirements

3.4 EO Areas and EO Buildings (including Laboratories, Test Facilities, Research and Development) must be:

a. Classified into Explosives Hazardous Areas (EHA) and/or Restricted Electrical Areas (REA).

b. Subject to planned, effective housekeeping activities.

c. Provided with suitable protection by complying with this regulation and the referenced procedures.

Requirements for the Protection of Explosive Ordnance against Electrostatic Discharge Hazards

3.5 The explosive train of some initiation systems contain an electrically initiated explosive device. Being electrically initiated, specific precautions are required to be observed with stores containing Electro Explosive Devices (EED). These precautions may apply in activities such as logistic movement, during assembly, disassembly, testing, inspection and repair when in workshops and in storage. The required level of precautions that are to apply is dependant on the susceptibility of the most sensitive component. Whenever susceptible EO is being handled, it is essential that this safety policy is applied. Refer to DEOP 204.001-022(AM1) to assist in determining whether it is susceptible to electrostatic hazards.

3.6 **Electrostatic Precautions.** The sources of static electricity are to be controlled by employing the following techniques whenever susceptible EO is being handled:

a. The use of conductive or antistatic flooring.

b. Earthing and/or bonding of personnel, plant, tools, benches, racks, and weapons.

c. Control of humidity.

d. Use of Hazardous Area Personnel Test Meter (HAPTM).

e. Avoidance of plastic and polymer materials and packaging.

f. Suitable antistatic clothing.

General Electrical Requirements for Mechanical Handling Equipment and Vehicles for Use in Explosive Hazardous Areas

3.7 MHE and Vehicles must be suitable for the classification that is given to the area that they operate within (refer to Procedure 1 for classification of EO areas). Requests for use of new handling equipment in EHA are to be referred to Director Ordnance Safety for approval.

3.8 Design Construction and Specification Requirements. The general design construction and specification requirements for vehicles and MHE are as follows:

a. **Identification.** Mobile MHE must have a means of clearly identifying them and the EO area that they are authorised to operate within.

b. **Tyres.** The tyre of at least one road wheel is to be electrically conducting.

c. **Ancillaries.** Ancillary items in use with vehicles and powered MHE are to comply with the equivalent standards as those required by this regulation for the main equipment.

Responsibilities

3.9 This regulation applies to all personnel who are involved with the planning, design, acceptance, and maintenance of EO facilities.

3.10 For new facilities and for alterations to existing facilities, the persons or parties in control of the operation of the installation are responsible for having the explosives areas classified. The classification shall be delegated to a competent person.

3.11 Personnel undertaking classification are to consult with all relevant stakeholders which must include representatives from the user, the Licensing Authority and from the Explosives Storage and Transport Committee.

3.12 The OIC of the area shall ensure that competent persons inspect and maintain the installations.

3.13 The OIC shall ensure vehicles and MHE for use within EAs are permitted for the classification and that the vehicles conform and remain conforming to the requirements of the procedures within this regulation.

3.14 Vehicle and MHE speed and load limits are to be defined and promulgated by the OIC of the area that the vehicle and MHE are to be operated within.

Procedures

3.15 Procedures used to implement the requirements of this regulation are:

a. Procedure 1 – Safety Requirements for Electrical Equipment and Installations for Explosives Area.

b. Procedure 2 – Protection of Explosive Ordnance against Electrostatic Discharge Hazards.

c. Procedure 3 – Electrical requirements for Mechanical Handling Equipment and Vehicles for use in Explosive Areas.

PROCEDURE 1 - SAFETY REQUIREMENTS FOR ELECTRICAL EQUIPMENT AND INSTALLATIONS FOR EXPLOSIVES AREA

Introduction

1.1 This procedure shall be applied by competent personnel to design, inspect, test, repair and maintain electrical installations. This will necessitate specific competencies and awareness of the requirements of this Procedure to ensure the installation complies. The selectors and installers shall do the selection and installation based on the designer's documentation. The designer shall document the necessary requirements for the selectors and installers to comply with this Procedure.

Purpose

1.2 The purpose of this procedure is to manage the risks to personnel and property from ignition sources in Explosive Ordnance (EO) areas by eliminating the risks as reasonably practicable, and if it is not reasonably practicable to do so, to minimise those risks so far as is reasonably practicable.

Applicability

1.3 This procedure applies to all facilities that contain EO. It is not intended that whenever this instruction, or the Australian Standards to which it refers, are amended, remedial works should be undertaken to modify existing electrical installations to make them conform to the revision unless there are safety related issues that require consideration.

Safety related revisions

1.4 When this Procedure or the referenced Australian Standards are changed for **safety related reasons**, the impact on existing installations shall be assessed and where appropriate, changes made. Any risk assessment process shall be consistent with the Commonwealth WHS Act, Regulations and Codes of Practice. A list of related standards is provided in Annex A.

Design competencies

1.5 For Explosives Hazardous Areas design the competent person shall:

a. Have the knowledge, skill and experience to design conventional hazardous areas (as defined in AS/NZS 3000).

b. Be able to apply the requirements of this procedure.

c. Be able to design and document the complying installation.

1.6 For Restricted Electrical Areas design the person shall:

a. Be able to apply the requirements of this procedure.

b. Have the knowledge, skill and experience to design installations complying with AS/NZS 3000.

c. Be able to design and document the complying installation.

Design

1.7 This procedure shall be applied by competent personnel to design electrical installations for explosives ordnance (EO) areas prior to construction. The complying design shall be prepared and documented before being implemented. This design requirement applies to new work and alterations to existing installations and shall provide an accurate record of the installation at that time. This Procedure details the additional requirements to permit electrical installations in EO areas.

1.8 Designs shall be documented in a manner that communicates a complying design solution in sufficient detail for the intended selectors and installers. Design details and instructions shall be relevant to the specific application. Avoid the inclusion of irrelevant requirements and details. The selectors and installers shall implement the design using the design documentation provided.

Documentation shall be complete and not rely on further reference to this Procedure by the selectors and installers.

1.9 All new and altered electrical installations in EO facilities shall comply with the requirements of this procedure and the Chapters of the Manual of Infrastructure Engineering - Electrical (MIEE) policy document which are relevant to the work and which can be found on the Defence Estate Quality Management System (DEQMS) web site on www.defence.gov.au/IM. The MIEE contains additional requirements which are common to all Defence electrical installations.

Design Certification

1.10 The design shall be certified as complying with this document by the competent designer(s) for those parts of the work designed by the competent designer(s). The installation shall be certified as complying with this document by the competent installer(s) for those parts of the work completed by the installer(s).

1.11 The designer(s) shall include appropriate hold points for the construction and shall inspect the installation for compliance at each hold point. Hold points shall be specified for work that is difficult to inspect and verify after completion of the works. These shall include lightning protection earth termination network, equipotential bonding of the structure and location/depth of burial of underground services.

1.12 The designer(s) shall certify that they have verified compliance from their inspections at the required hold points.

1.13 Design certification and construction certification shall be provided and shall include the forms and information required in Appendix A of the MIEE.

CLASSIFICATION OF EXPLOSIVES AREAS

1.14 For the purposes of this regulation EO areas are divided into Explosives Hazardous Areas (EHA), Restricted Electrical Areas (REA) and AS/NZS 3000 Hazardous Areas. An EHA is an area in which an explosive substance is or may be exposed to the atmosphere. An REA is an area containing EO in which an explosive substance is not exposed to the atmosphere. The explosives areas shall be classified in accordance with the flowchart in Annex B.

1.15 Vapours, gases or dusts of explosives do not require oxygen to ignite as they are inherently explosive whether airborne or not. The classification of the explosives areas is based on the probability of the explosive material existing. It is not based on the probability of the explosive material being mixed or suspended in air to form an explosive mixture. The explosives materials are explosive at all times in any quantity. Conventional hazardous area classification is based on flammable gases or vapours or combustible dusts becoming explosive only when mixed with air in the correct proportions. The conventional hazardous area classification standards (AS/NZS 60079.10.1 and AS/NZS 60079.10.2) cannot be used to classify explosives hazardous areas.

Note:

> It is possible that explosives hazardous areas of this procedure and the conventional hazardous areas as defined in the Australian Standards can exist simultaneously. For example, solvents may be used in a work area and be present in a bay where processed explosives may give rise to dusts of explosives. Consequently, it is necessary to classify the Zones accordingly.

1.16 The responsibility for the classification of the explosives areas rests with the OIC/User.

1.17 The OIC shall ensure the required classifications have been determined.

1.18 For the purpose of this procedure, explosives areas are classified into:

a. Explosives Hazardous Areas (EHA) – comprising:

(1) An area in which an explosive substance is or may be exposed to the atmosphere (Zones 0E, 1E, 2E, 20E, 21E, 22E and 33E)

(2) An area in laboratories and test facilities, where very small quantities of explosives are prepared and tested by an authorised competent person and its

ignition could not cause the subsequent initiation of other hazardous materials, significant damage to equipment or injury to personnel (Zone SE)

(3) An enclosed area in which an exposed explosives substance is or may sublime (Zone SP). In the open the condensate will evaporate at a rate greater than the rate of release by the source because its surface area is much greater. Even when a build-up occurs, the quantities are typically micrograms and pose an insignificant risk. In this regard a typical bay/laboratory would be considered an open space and not be classified as Zone SP. In closed situations this may not be true and may be Zone SP.

b. Restricted Electrical Areas (REA) - An area containing EO where the explosive substances are not exposed and an explosive atmosphere will not exist

Greater detail on the requirements for EHAs (Annex C) and REAs (Annex D) are contained within their respective annex.

Qualifications and competency

1.19 A competent person is a person, who has acquired, through training, qualification and experience, the knowledge and skills enabling that person to perform the required task correctly.

1.20 For Explosives Hazardous Areas classification the competent person shall understand the nature of explosives materials and also have the training and experience to classify conventional hazardous areas (as defined in AS/NZS 3000).

1.21 For Restricted Electrical Areas classification the person shall be competent in the storage and handling of EO.

Classification of Explosives Hazardous Areas

1.22 Competent persons must be engaged during the planning phase for any new works, alterations or change of use to classify the EHAs with the information on the properties of the explosive materials and the work activities. The classification of EHAs must be determined fully. A flow chart summarising the steps and sequence of classification are shown in Annex B “Explosives Areas Classification”. This must be read in conjunction with the requirements of this procedure. The person with the classification competencies must do the actual classification. It is not sufficient for a competent classifier to check the work of a person without the required competencies.

1.23 The hazardous area classification shall include a record of the following as applicable:

a. Zone(s) classification and extents

b. Minimum ignition temperature of each explosives vapour or gas

c. Minimum ignition energy of each explosives vapour or gas

d. Minimum ignition temperature of each explosives dust

e. Minimum ignition energy of each explosives dust

f. The lowest minimum and the highest maximum temperatures on record from the Australian Bureau of Meteorology for that locality

g. Ambient temperature ranges for the locations

h. Temperature influence from other factors e.g. the process temperature or exposure to solar radiation

i. Special Conditions such as electromagnetic radiation, vibration, corrosion, chemical influences, high levels of ultra violet light, moisture, chemical influences, mechanical impact and avoidance of light alloys shall be recorded

1.24 Careful consideration of the types of EO, exposed explosives, workshop practices and possible future site expansion must be taken into account when determining EHA boundaries. For example solid explosives, even a rubbery propellant, may give rise to dusts of explosives depending on the operations conducted. Explosives such as nitro-glycerine may give rise to vapours which can condense to liquid or crystalline explosive.

1.25 Special considerations are necessary when explosives are liable to sublime (e.g. NG or TNT) and electrical equipment should not be installed unless absolutely essential. In circumstances where electrical equipment is necessary, solutions must be developed by a professional engineer from first principles by developing suitable control measures appropriate to the identified hazards. This will involve the assistance of an explosives chemist and consultation with the Directorate of Ordnance Safety.

1.26 An explosives chemist will need to advise the properties of explosives in the process e.g. high explosives boiling out operations.

1.27 Hazardous Areas and Explosives Hazardous Areas may occur in the same location. The classification would need to include each type of Zone. It is also possible to have dusts and vapours present in the same location. For example the Zone Classification for one location may be “Zone 1, 1E, 22E”. Where the EHA and HA are coincident, seek advice regarding the nature of the coincident hazard from an explosives chemist to determine the ignition characteristics of the combination.

1.28 The frequency and effectiveness of housekeeping is an important consideration in determining the appropriate classification of an EHA. Dust is cumulative and whilst a single operation may be thought to produce an insignificant quantity of dust, repeated operations may cause significant amounts of explosive to accumulate and enter electrical equipment enclosures. Effective housekeeping standards are required to prevent a Zone 22E degenerating to Zone 21E or Zone 20E. These must be specified in the classification report and the verification dossier for the installation.

Classification of EHA Zones

1.29 The Explosives Hazardous Areas containing or likely to contain exposed explosives are classified into the following zones (refer to Annex B):

a. Zone 0E is an area in which the vapour or gas of explosives is present continuously, or for long periods or frequently.

b. Zone 1E is an area in which the vapour or gas of explosives is likely to occur in normal operation occasionally.

c. Zone 2E is an area in which the vapour or gas of explosives is not likely to occur in normal operation but, if it does occur, it will exist for a short period only.

d. Zone 20E is an area in which the dusts of explosives are present continuously, or for long periods or frequently.

e. Zone 21E is an area in which the dusts of explosives are likely to occur in normal operation occasionally.

f. Zone 22E is an area in which the dusts of explosives are not likely to occur in normal operation but, if it does occur it will exist for a short period only.

g. Zone 33E is an area in which an explosives substance will be exposed to the atmosphere and in which the vapour or gas of explosives will not occur and the dusts of explosives will not occur.

h. Zone SE is an area in laboratories and test facilities where very small quantities of explosives are prepared and tested by an authorised suitably qualified person; and its ignition could not cause the subsequent initiation of other hazardous materials, significant damage to equipment or injury to personnel.

i. Zone SP is an area within the containment boundary in which exposed explosives substances sublime or may sublime. In the open the condensate will evaporate at a rate greater than the source because its surface area is much greater. Even when a build-up occurs, the quantities are typically micrograms and pose an insignificant risk. In this regard a typical bay/laboratory would be considered an open space and not be classified as Zone SP. In closed situations this may not be true and may be Zone SP.

1.30 **Extent of EHA Zones** shall be determined during the planning phase for any new works or alterations and are to be clearly documented. This shall require consultation and coordination with the users, owner and designers. Ceilings, ducts, voids and cavities in EHA need to be sealed effectively to prevent entry of the explosives materials. This is necessary to stop these spaces being classified as EHA Zones. The EHA shall be protected appropriately from likely sources of flames, sparks, projectiles and radiant heat from outside the boundary.

a. The extent must be determined based on the specific circumstances. The extent of the EHA Zones depends on each installation based on quantities, properties of the materials, layout and ventilation. Relevant information may be acquired from Energetic Material Qualification (EMQ), Explosives Hazard Data Sheet (EHDS), Safety Certificate, Safety Data Sheet (SDS), explosives chemists and user. The extent of the EHA Zones shall be:

(1) Zone 0E – an area in which the vapour or gas of explosives is present continuously, or for long periods or frequently. Typically would be inside vessels and containers however may extend outside of openings where the vapours can vent to the atmosphere. Other locations would include where sampling or decanting occurs frequently. The extent inside the vessels/containers would be limited by the walls of the vessels/containers. The extent of the Zone beyond the openings is determined by the volume and the characteristics of the explosives gases and vapours.

(2) Zone 1E - is an area in which the vapour or gas of explosives is likely to occur in normal operation occasionally. The extent of the Zone is determined by the volume and the characteristics of the explosives gases and vapours. The distance beyond the openings such as vents, unsealed penetrations, doorways and openings in doorframes for security sensors shall be considered and established. The distance shall be a minimum of 3 m but may need to exceed this.

(3) Zone 2E - area in which the vapour or gas of explosives is not likely to occur in normal operation but, if it does occur, will exist for a short period only. The extent of the Zone is determined by the volume and the characteristics of the explosives gases and vapours. The distance beyond the openings such as vents, unsealed penetrations, doorways and openings in doorframes for security sensors shall be considered and established. The distance shall be a minimum of 3 m but may need to exceed this.

(4) Zone 20E - an area in which the dusts of explosives are present continuously, or for long periods or frequently. Typically would be inside vessels and containers however may extend outside of openings where the dusts can be released to the atmosphere. Other locations would include where sampling or transfer occurs frequently. The extent inside the vessels/containers would be limited by the walls of the vessels/containers. The extent of the Zone beyond the openings is determined by the characteristics of the explosives dusts. The extent must be determined based on the specific circumstances. The size of explosives dust particles, rate at which any dust is deposited, the frequency of cleaning and the effectiveness of the cleaning affects the boundary.

(5) Zone 21E - an area in which the dusts of explosives are likely to occur in normal operation occasionally. The extent must be determined based on the specific circumstances. The dust release rate, the quantity released, the dust particle size, the release mechanism and the air movement, properties of the materials, layout, rate at which any dust is deposited, the frequency of cleaning and the effectiveness of the cleaning will affect the type and extent of the Zone. Relevant information may be acquired from the user. The distance beyond the openings such as vents, unsealed penetrations, doorways and openings in doorframes for security sensors shall be considered and established. The distance shall be a minimum of 3 m but may need to exceed this.

(6) Zone 22E - an area in which the dusts of explosives are not likely to occur in normal operation but, if it does occur it will exist for a short period only. The extent must be determined based on the specific circumstances. The dust release rate, the quantity released, the dust particle size, the release mechanism and the air movement, properties of the materials, layout, rate at which any dust is deposited, the frequency of cleaning and the effectiveness of the cleaning will affect the type and extent of the Zone. Relevant information may be acquired from the user. The distance beyond the openings such as vents, unsealed penetrations, doorways and openings in doorframes for security sensors shall be considered and established. The distance shall be a minimum of 3 m but may need to exceed this.

(7) Zone 33E - A Zone 33E extent is determined by the location of the EO and the general requirements above.

(8) Zone SE - applies only in laboratories and test facilities, where very small quantities of explosives are prepared and tested by an authorised competent person and its ignition could not cause the subsequent initiation of other hazardous materials, significant damage to equipment or injury to personnel. The size of explosives dust particles, rate at which any dust is deposited, the frequency of cleaning and the effectiveness of the cleaning affects the boundary. Relevant information may be acquired from the user. It shall extend at least 1 m laterally beyond the boundaries of the work area, extending down to the floor area including the area underneath the benches and up to the height of the ceiling.

(9) Zone SP – Zone SP is an area in which exposed explosives substances sublime or may sublime. The extent of the EHA Zones depend on each installation based on quantities, properties of the materials, layout and ventilation.

b. **Adjacent Zones –** Explosives Hazardous Areas Zones and/or AS/NZS 3000 Hazardous Areas Zones may occur adjacent to each other. Where there are adjacent Zones the delineation between the areas shall be clearly identified.

c. **Coincident Zones –** A coincident zone is an area where different EHA and/or AS/NZS 3000 HA Zones exist in the same space. Where there are coincident Zones, the ignition properties of the coincident explosives materials may be more sensitive to ignition by spark and/or a hot surface of the coincident substances than the ignition properties of any of the substances in the individual Zones. The ignition properties of the coincident substances need to be established. Where the EHA and AS/NZS 3000 HA are coincident, seek advice regarding the nature of the coincident hazard from an explosives chemist to determine the ignition characteristics of the coincident substances. Determine any further precautions required.

Determination of Minimum Ignition Energy

1.31 The minimum ignition energy shall be recorded in mJ or µJ to be used as detailed in Annex C for determining the permitted Groups.

Classification of Temperature Class

1.32 **The T-Class**: For Zone 0E, 1E and 2E the appropriate T-Class shall be the lower of the minimum ignition temperature of the hazardous vapour or gases or 100°C (T5)

Classification of Maximum Surface Temperature

1.33 **The Maximum Surface Temperature:** For Zone 20E, 21E and 22E the appropriate Maximum Surface Temperature shall be the lowest of the following temperatures:

a. The minimum ignition temperature of the explosives dust less 50°C; or

b. 100°C

Note:

Where there are coincident Zones, the ignition temperature by a hot surface of the coincident substances may be lower than the ignition temperature of any of the substances in the individual Zones. The characteristics of the coincident substances need to be established and the lowest temperature used for the T-Class or Maximum Surface Temperature.

Determination of Ambient Temperature and Special Conditions

1.34 The Ambient Temperature ranges shall be established for each location taking into account temperature influence from other factors e.g. the process temperature or exposure to solar radiation and global warming. Note that the lowest minimum and the highest maximum temperatures on record from the Australian Bureau of Meteorology for that locality shall be used for the basis of determining the ambient temperature range.

1.35 Special Conditions such as electromagnetic radiation, vibration, corrosion, chemical influences, high levels of ultra violet light, moisture, chemical influences, mechanical impact and avoidance of light alloys shall be recorded.

Classification of Restricted Electrical Areas (REA)

1.36 Advice on the classification of an REA must be provided by persons competent in the handling and storage of EO, who have an understanding of the work activities and who can confirm that the EO remains contained.

1.37 An REA is an area containing EO where the explosive substances are not exposed and an explosive atmosphere will not exist. The classification must verify the EO location does not have any exposed explosives or explosives which may give rise to an atmosphere of vapours, gases or dusts of explosives and the EO remains contained.

1.38 The boundaries of the REA shall be determined during the planning phase for any new works or alterations and are to be clearly documented. This shall require consultation and coordination with the users, owner and designers.

Note:

> The REA includes all ceiling spaces, ducts, voids and cavities which are not separated by the effective barrier.

1.39 The REA for large open spaces within an area shall include the horizontal space within 15m in all directions from where the EO is located. Installations above this space shall be REA compliant. Installations beyond the REA boundary shall have effective measures to prevent fire from entering the REA.

1.40 The REA shall be protected appropriately from likely sources of flames, sparks, projectiles and radiant heat. Such sources shall be separated from openings by a distance of at least 15 m in the directions which would allow direct entry. This would permit non-REA compliant equipment to be installed externally such that the likely sources cannot have a direct line of travel through the openings.

COMMON REQUIREMENTS FOR REA AND EHA

1.41 The design documentation which is prepared for a new or modified installation shall specify requirements in sufficient detail to ensure the following common requirements will be met for an REA or EHA installation**.** The requirements shall be in a form suited to the skills and competencies of the intended audience. An attempt shall be made to tailor the information to the particular application and to limit requirements to those directly relevant to the particular installation.

Competencies

1.42 A competent person is a person, who has acquired, through training, qualification and experience, the knowledge and skills enabling that person to perform the required task correctly.

1.43 Where a sub-component of the design is selected by another competent designer, the overall competent designer must verify that the selected equipment is suitable for the hazardous area location.

1.44 For EHA the selectors shall be competent to select electrical equipment in hazardous areas as defined in AS/NZS 3000. Guidance for competencies in hazardous areas is provided in AS/NZS 4761.1 - *Competencies for Working with Electrical Equipment in Hazardous Areas (EEHA)*. Appropriate continuing education and training should be undertaken by personnel on a regular basis. In addition they must apply the selection requirements prescribed in this regulation. The persons with the specific competencies must be the persons who carry out the specific task(s). It is not sufficient for a competent person to check the work of a person without the required competencies.

1.45 For REA the selectors shall be competent to select electrical equipment in accordance with the requirements of AS/NZS 3000. In addition they must apply the selection requirements prescribed in this regulation.

1.46 For EHA the installers shall be competent to install electrical equipment in hazardous areas as defined in AS/NZS 3000. Guidance for competencies in hazardous areas is provided in AS/NZS 4761.1 - *Competencies for Working with Electrical Equipment in Hazardous Areas (EEHA)*. Appropriate continuing education and training should be undertaken by personnel on a regular basis. In addition they must apply the installation requirements prescribed in this regulation. The persons with the specific competencies must be the persons who carry out the specific task(s). It is not sufficient for a competent person to check the work of a person without the required competencies.

1.47 For REA the installers shall be competent to install electrical equipment in accordance with the requirements of AS/NZS 3000. In addition they must apply the installation requirements prescribed in this regulation.

1.48 Only locate essential electrical equipment inside the EO area. Consider hydraulic or pneumatic actuation as alternatives to electrical equipment where this provides a higher order hazard control measure as required by the WHS Regulations.

1.49 In addition to the protection afforded by explosion protection techniques and the standard electrical practices which provide a safe working environment within facilities containing EO, further precautions are required to prevent both natural and man-made electrical phenomena initiating events that could ignite explosives materials.

1.50 These phenomena may be split into three categories:

a. **Static** – Static electricity generated by personnel, fluids, compressed air, machines, and the movement of materials. Static protection is detailed in Regulation 6.3 Procedure 2.

b. **Lightning ground flash –** Discharge of static electricity from the atmosphere to the ground. Protection against lightning is detailed in Regulation 6.2 Procedure 1.

c. **Electromagnetic** – Electric and magnetic fields generated in the vicinity of transmission lines and electrical devices, by high currents, switching of inductive loads, surges due to lightning discharges and RF transmissions etc. Electromagnetic hazard (RADHAZ) protection is detailed in Regulation 4.4 Procedure 15.

1.51 Any special or unusual condition not dealt with or any points of doubt or difficulty are to be referred to the Director Ordnance Safety (DOS) for guidance or special requirements.

Lightning Protection

1.52 Lightning Protection Systems (LPS) for EO facilities and other structures are to be selected and installed in accordance with the requirements of this procedure and the latest revision of Australian/New Zealand Standard AS/NZS 1768 Lightning Protection (see Regulation 6.2 Procedure 1).

1.53 Lightning protection shall be applied to all EO facilities using Protection Level I based on a rolling sphere of radius 20 m. The recommendations and requirements of Clause 7.5.4 - Structures with explosive or highly-flammable contents of AS/NZS 1768 Lightning Protection shall be applied. Where anti-static precautions are required for process buildings and the like or where EO will not be adequately isolated from the building perimeter, designers are cautioned against supporting air terminals and down conductors from the building itself due to the inherent hazards associated with discharging the lightning current over the surface of the structure to be protected.

1.54 Lightning protection utilising external air terminals, down conductors and earth terminations incorporating a buried ring conductor shall be used. Earth covered magazines generally do not have adequate cover over the entire structure to be considered inherently protected by the earth covering and require additional external air terminals in some form.

1.55 An earthing conductor, deemed to be the main earthing conductor, shall be taken from the switchboard main earthing bar to an earth electrode complying with AS/NZS 3000. This switchboard earth electrode shall be bonded to the lightning protection earth electrodes and buried ring conductor system. It is preferable that this bonding be done by direct in-ground connection between the earth electrodes of the two systems.

1.56 Designers are cautioned against lightning protection solutions which rely on any of the building structure to serve as part(s) of the air termination network, down conductors or earth termination network. These would be considered an alternative design solution subject to dispensation approval. Designers would need to provide an engineering assessment to prove the adequacy of the solution from first principles.

Static Protection

1.57 The applicability of these requirements needs to be specifically confirmed by the user. Where precautions against static discharge are required due to the presence of electro explosive devices (EED) or for other reasons requiring the protection of explosive ordnance against uncontrolled static discharge, refer to Regulation 6.3 Procedure 2 of eDEOP 101 for guidelines and requirements.

1.58 Explosives materials, where exposed with electrical discharge sensitivity below 45 mJ should be considered as requiring maximum electrostatic precautions. Refer to Annex A of Regulation 6.3 Procedure 2 and Regulation 6.3 Procedure 2.

1.59 A static protection system inside a building shall be isolated from the lightning protection air termination and down conductor systems (to prevent flash over).

1.60 Where protection against static discharge is required, an equipotential bonding bar shall be established adjacent the switchboard which supplies the EHA. It shall be connected directly to the main protective earth bar of the switchboard. This bar shall be used to bond the static protection systems.

System integrity

1.61 EO facilities may include other services such as, telecommunications, fire detection and electronic security systems. These systems need to be suitable for the EO classification.

1.62 Services in EO facilities shall be compatible so that one service does not adversely affect the safety of the other service(s). Additional measures shall be provided to protect these services from external influences. Such requirements include:

a. Separation of site High Voltage (HV) power supply from EO area;

b. Mechanical protection of cabling either by armouring or other approved enclosure;

c. Ingress protection from solids and liquids;

d. Location of power switchboards outside EO facilities/area;

e. Protection of site power supply from direct and induced surges, generated by natural and artificial means e.g. lightning and utility power surges;

f. Suppression of static electricity using earth bonding and installation of conductive material within EO areas. This can include other forms of suppression such as humidification and ionisation;

g. Suppression of Electromagnetic Radiation (EMR) by use of shielding, isolation and correct equipment selection to prevent Electromagnetic Interference (EMI); and

h. Protection of individual areas and structures from external influences including bushfire.

Regulations, standards and codes of practice

1.63 A list of regulations, associated standards and Codes of Practice referenced by this procedure is provided at Annex A.

1.64 Reference should be made as appropriate to these and other relevant Australian Standards, the Australian Communications and Media Authority (ACMA) requirements and any relevant local supply utility and statutory authority regulations.

Display of explosive hazardous area classifications

1.65 The EHA zones and REA classification of EO areas are to be clearly marked immediately adjacent to each entry to the area, and on the door of the main switchboard for the area.

Radio and radar emitter installation

1.66 Ideally, emitters should be sited beyond Inhabited Building Distance (IBD) of any EO area in order to avoid damage in event of an explosion. They may be sited at smaller distances when this operationally necessary and the risk of their damage is acceptable. Some protection can be afforded to the installation within the IBD by providing an effective traverse to them, where this can be done without interfering with their operation.

1.67 Where an emitter is considered vital, 1.5 times the IBD is to be observed as a minimum. This greater distance provides a better degree of protection to the emitter, particularly with respect to the shock wave from EO in Hazard Division 1.1 and the debris from EO in Hazard Division 1.1 and 1.2.

1.68 Radio Frequency (RF) radiation has the intrinsic capability to induce significant electrical power or energy levels in any unprotected electrical circuit within the RF field. If an exposed circuit contains an Electro-Explosive Device (EED) a potentially hazardous situation may exist. Precautions must therefore be taken to ensure that EEDs are not inadvertently initiated by RF radiation. Regulation 4.4 Procedure 15 outlines the precautions during Defence EO activities to ensure that RF emissions do not present a hazard to EO.

Electrical Supply and Supply Infrastructure

1.69 The electrical supply cabling within an Explosives Area site may be by means of underground cables or supported overhead lines. Underground cables are preferred wherever practicable except they shall not be laid below EO buildings or facilities. Aerial wiring systems are not permitted inside or above REA or EHA. Overhead transmission systems (e.g. which are part of a main distribution grid) are not permitted in, or to pass over EO storage areas and buildings.

1.70 The electricity supply to EO buildings or areas may be direct or alternating current; the voltage to earth shall not exceed 250V RMS nominal and one point of the system shall be earth referenced at the source.

1.71 Surge protection shall be provided to the incoming power supply and all other external cabling terminated at the EO building or area switchboard in accordance with the recommendations of AS/NZS 1768 Protection Level I.

1.72 Overhead power lines shall comply with the following:

a. Overhead power lines within the Explosives Area shall not cross roads where vehicles loaded with explosives are expected to travel.

b. Overhead power lines are not permitted in, or to pass over, an EO area or EO buildings.

c. Overhead power lines shall be located at a safe distance from the perimeter of such areas for the mutual protection of Supply Authority infrastructure and EO infrastructure:

(1) In the event of an unintended explosive event, for the protection of Supply Authority infrastructure the minimum distance between an EO building and Supply Authority overhead transmission towers and power lines (e.g. which are part of a main distribution grid), shall be equal to the Inhabited Building Distance, subject to a minimum separation of 120 metres.

(2) For the protection of EO infrastructure, safe distances are to be maintained for all overhead power lines to ensure that, in the event of a conductor breaking or a line support tower failing, neither the support nor the conductor is able to fall on to any part of an EO building. All overhead power lines shall be located at least 15 metres or the length of one span (whichever is the greater distance), measured horizontally from the EO building or EO area.

1.73 Up-to-date, as installed plans of all external cables shall be retained on site at the EO facilities. Plans shall show the locations of all joints in cables, cable pits, earth electrodes as well as the locations and depth of cables and the locations and heights of poles.

Defence Information Communications Technology (ICT) cabling

1.74 Defence Information Communications Technology (ICT) cabling shall in addition to the requirements specified in this Procedure, comply with the requirements of Chief Information Officer Group (CIOG) Intranet: http://intranet.defence.gov.au/cio/ as published in the Defence Communications Cabling Standard.

Extra Low Voltage Cabling (ELV) Cabling

1.75 All telecommunications and Extra Low Voltage cables other than Defence ICT cables shall meet the minimum requirements of AS/ACIF S009, the Australian Communications and Media Authority requirements and AS/NZS 3000 requirements as applicable.

Underground high voltage distribution

1.76 Underground High Voltage (HV) cables terminating in earthed metal enclosures which are designed to remain intact for arc faults up to the prospective fault level, shall be located at least 15 metres from an explosives area. HV cables terminating in bushing type cable heads or similar terminations are to be located at least 45 metres from an explosives area.

1.77 Underground HV cables shall not be installed below any EO area or below any EA.

1.78 Underground HV cables shall be buried to comply with AS 2067.

1.79 Cable route markers consisting of aluminium identification markers, set in concrete set into the ground with permanent arrows showing direction of run, shall be provided at every change of direction of run and every 30 metres in straight runs of underground cables. Permanent labels in the route markers shall read “DANGER HIGH VOLTAGE ELECTRICAL CABLES BELOW”.

Underground low voltage distribution

1.80 All underground low voltage (LV) cables shall be installed in accordance with the requirements of AS/NZS 3000.

1.81 Cable route markers consisting of aluminium identification markers, set in concrete set into the ground with permanent arrows showing direction of run, shall be provided at every change of direction of run and every 30 metres in straight runs of underground cables. Permanent labels on the route markers shall read “DANGER LOW VOLTAGE ELECTRICAL CABLES BELOW”.

1.82 Electrical supply into EO buildings (or areas) shall be by an underground cable which terminates in a switchboard located either external to the building (or EO area) or in a plant room which is fire and smoke separated from the EO and does not open directly into the area or rooms containing the explosives.

1.83 LV cables may be located under EO buildings or areas solely for the purposes of entry to the buildings or area. Cables located below concrete slabs or other permanent floors shall be installed in conduit. Only sweep bends are permitted.

Underground Defence Information Communications Technology (ICT) cabling

1.84 Defence Information Communications Technology (ICT) cabling shall comply with the requirements of the Defence Communications Cabling Standard.

Underground ELV Cabling

1.85 All underground telecommunications and Extra Low Voltage cables other than Defence ICT cables shall meet the minimum requirements of AS/ACIF S009, the Australian Communications and Media Authority requirements and AS/NZS 3000 requirements as applicable.

Substations and supply equipment

1.86 Substations shall be comprised of HV switchgear, transformers and LV switchgear, each in a separate enclosure or room.

1.87 HV warning and substation designation labels to AS 1319 shall be fitted to all substation doors and gates which access areas containing HV equipment. Warning signs shall include “DANGER HIGH VOLTAGE” and “AUTHORISED PERSONS ONLY” within HV substations and switch rooms.

1.88 Substations shall be provided with a “Combined Earthing System for Substations” to the requirements of AS 2067.

1.89 Transformers and switchgear for use with underground HV cable operating at less than 33 kV may be adjacent or integral to EO areas subject to the following conditions:

a. Adequate surge protection is provided.

b. The switch room and transformer bay shall be separated from the EO area by walls capable of containing and directing away from the EO, any fire or blast which could potentially arise from the equipment.

1.90 Transformers not complying with the above requirements and bushing type transformers for use with overhead HV cables shall be located no less than 45 metres from any EO area.

Siting of electrical generating equipment within EO areas

1.91 Generating equipment operating at a voltage of 650 V RMS to earth or less shall be located more than 10 metres from any EO area, unless completely housed in a separate building or structure with no common opening to the areas containing explosives.

1.92 Generating equipment operating at a voltage of more than 650 V RMS to earth shall be located more than 45 metres from any EO area.

General Arrangements Control and Protection

1.93 Switchboards shall be located outside of the EO building or otherwise in a room which is fire and smoke separated from the EO and does not open directly into an REA or EHA. Each EO building shall have a dedicated switchboard and be connected as per AS/NZS 3000 as a main switchboard or an outbuilding switchboard with a dedicated Multiple Earthed Neutral (MEN) connection at the switchboard.

1.94 Switchboards shall be constructed in accordance with AS/NZS 3000 and AS/NZS 3439. Specific applications may require the use of alternative materials such as aluminium or stainless steel because of environmental considerations.

1.95 Switchboards located external to the area shall be of weatherproof, ventilated, vermin proof construction, tropic proofing (where applicable) and adequate lighting.

1.96 A 10 amp switched socket outlet shall be provided beneath a lockable cover on or near switchboards.

1.97 Cable entry should preferably be from the bottom of the switchboard or from an extension duct fitted to the bottom of the switchboard.

1.98 In new installations or when switchboards are refurbished, switchboards shall have 25% minimum spare space for additional future circuits and protection. The switchboard and main switch shall be easily accessible.

1.99 Where cables enter or leave an EO building the penetration shall be sealed. Where conduits enter or leave an EO area, the penetration and conduits shall be sealed.

1.100 The switchboard shall incorporate a means of isolating the general REA/EHA electrical installation when the REA/EHA is unoccupied. Separate mains isolator(s) shall be provided for any systems inside the REA/EHA which have been approved to run with the area unoccupied. Separate isolator(s) shall be provided for the electrical installation outside the REA/EHA which is connected to the same switchboard.

1.101 The location of all isolation facilities for the REA/EHA installation shall be identifiable from outside of the switchboard with the switchboard doors closed. All isolators shall be readily accessible in an emergency and able to be locked in the off position.

1.102 The installation shall provide convenient clearly and permanently labelled isolation facilities suitable for operation by non-competent persons to enable the routine isolation of all non-essential power by the users whenever the REA/EHA is unoccupied. Provide clearly and permanently labelled separate isolation facilities for power to essential services. This shall reduce the likelihood of an electrical fire. External indication of this isolation status shall be provided. (This clause is not intended to apply to fire protection and security system devices).

1.103 When operated, the REA/EHA Electrical Installation Isolator (for electrical installations within the REA/EHA) shall isolate all active conductors including the neutral and emergency luminaire supply conductors.

1.104 Each final sub-circuit shall have its own return neutral conductor. Common neutrals for multiple final sub-circuits are prohibited.

1.105 Final sub-circuits for the electrical installation inside the REA/EHA shall be provided with protection by a Residual Current Device (RCD) with a maximum rated residual current of 30 mA for all circuits rated 20A or less. Other circuits shall have residual current ratings appropriate for the connected equipment but in no case rated at more than 100mA. The protection devices for final sub-circuits shall interrupt the active and neutral conductors.

Note:

Although all single phase RCD's monitor the current through the neutral conductor, they don't all isolate the neutral conductor once the RCD has tripped. Careful selection of protective devices is required.

1.106 Every REA/EHA shall have a minimum of two general lighting circuits.

1.107 Where switch socket outlets have been permitted and deemed essential for operational reasons, each assembly shall have a dedicated circuit with overcurrent trip setting to best match the continuous rating of the outlet assembly. Permanently connected equipment shall have overload protection to match the rating of the equipment.

1.108 Low voltage electrical installations in REA/EHA shall be protected against short duration high amplitude transient overvoltage from lightning or other sources. They shall also be protected against longer duration over or under voltage conditions (outside the permitted voltage limits as defined in AS/NZS 3000:2007 *Wiring Rules* and AS 60038 *Standard Voltages).* This may require the use of voltage sensing relays and contactors.

1.109 Extra low voltage installations in REA/EHA shall be protected against short duration high amplitude transient overvoltage from lightning or other sources. They shall also be protected against longer duration overvoltage conditions in accordance with the manufacturer's recommended voltage limits.

1.110 Surge protection devices shall be located close to but outside the REA/EHA. Surge protective devices shall include indicators for healthy/fault conditions and be mounted so the indicators are readily visible for inspection. Refer to AS/NZS 1768 *Lightning Protection* for guidance on surge protection type, rating and locations. Provide short circuit protection to limit follow-on current should the devices fail or their power handling capability be exceeded.

1.111 Switchboards, control panels, batteries and similar items must:

a. Be located outside an REA at least 1 metre from openings.

b. Be located outside an EHA beyond the EHA Zone boundary.

c. Be positioned such that flames, sparks, projectiles and radiant heat do not have a direct line of travel through the openings under fault conditions.

d. Have enclosures which are non-combustible.

1.112 Low voltage and extra low voltage equipment (including luminaires) shall be protected against overload and short circuits without damage that renders it unsuitable for further use. This requires the addition of overload protection for the equipment in addition to the short circuit protection offered for the wiring. The setting of the overload device shall be in accordance with the manufacturer's recommendation.

Note:

This may require overload protection to be located within the equipment in a manner and location determined by the manufacturer.

1.113 All overcurrent protection within switchboards shall be selected to grade and co-ordinate with the upstream protection. All overcurrent protection shall clear the prospective fault current without damage to the electrical installation or causing excessive heating. Clear and permanent labelling shall be provided to identify the location and rating of protective devices (which are enclosed within equipment) without the removal of an equipment cover.

1.114 Each switchboard shall have a printed circuit schedule card stored in a card holder located on the inside surface of the access door.

Luminaires

1.115 Lighting shall be adequate for the required tasks. Lighting design shall be in accordance with the AS/NZS 1680 series of standards. Adequate vertical and horizontal illuminance shall be provided to take account of the proposed layout, furnishings, racking and tasks. Location of luminaires shall take into account safe access and ease of maintenance. Luminaires shall comply with AS/NZS 60598 and with the additional requirements of Annex C and Annex D as appropriate for the area classification.

1.116 Single point self-contained emergency luminaires with integral batteries and chargers are not permitted within REA or EHA. Emergency lighting supply conductors which enter the REA/EHA shall be isolated when the REA/EHA Electrical Installation Isolator is open. Batteries shall be accommodated in a suitable environment and in a manner complying with AS 3011.2, AS 2676.2 and the Building Code of Australia.

1.117 Permitted solutions for emergency lighting are:

a. Single point emergency lighting system with the luminaire remote from the supply/control unit. The supply/control unit shall house the necessary components such as charger, battery, inverter, charge indicator, test switch and labelling. The supply/control unit shall not be located within the REA/EHA. The combination of the supply/control unit, wiring, connection, voltage sensing and luminaire must comply with the requirements of AS 2293.1 and AS 2293.3 for a single point system. This combination must be provided with a type test certificate of compliance from a National Association of Testing Authorities, Australia (NATA) accredited testing laboratory. The wiring interconnecting the luminaire and the supply/control unit shall comply with the wiring requirements for centrally supplied systems.

b. Central emergency lighting systems complying with the requirements of AS 2293.1 and AS 2293.3 for centrally supplied systems. Designers are cautioned regarding the possible conflict between the requirements of AS 2293.1 and this procedure regarding the need for RCD protection of final sub-circuits.

X-ray equipment

1.118 Where X-Ray equipment is required for the inspection of ammunition:

a. The main equipment should be confined to non EHA; and

b. X-Ray heads located in an EHA shall be installed within an appropriate enclosure for the location concerned or alternatively it is to be pressurised. The enclosure and the pressurization system shall comply with the protection requirements indicated in Table 1C-1 in Annex C; and

c. Control equipment located in an EHA shall comply with the relevant protection requirements indicated in Table 1C-1 in Annex C or shall be sited outside the EHA; and

d. X-ray equipment is considered a controlled apparatus under the ARPANSA Act. The possession and operation of controlled apparatus requires the issue of a Licence by CEO ARPANSA. Application for a Licence is to be co-ordinated through the Directorate of Radiation Safety and Environment (DSRE) as required by the Defence Radiation Safety Manual (DRSM);

e. Equipment located in REA shall comply with the requirements in Annex D.

Electrical requirements for mechanical handling equipment and vehicles

1.119 The minimum requirements for Mechanical Handling Equipment and Vehicles are outlined in Regulation 6.3 Procedure 3.

Portable Test Equipment for Ordnance

1.120 Test equipment for explosive ordnance to be used in an EO area shall be designed and manufactured for that specific purpose and used in accordance with the manufacturer’s instructions.

Labelling and marking

1.121 Refer to Defence Estate Quality Management System for guidelines, requirements and policy in the provision of labelling and marking of electrical services and installations in hazardous and explosive areas at EO storage areas owned and/or operated by Defence.

Note:

Labelling and marking of electrical services and installations is found by navigating to the ‘Governance, Risk & Compliance Portal’ (located on the middle left of the page) and selecting the ‘Legislation and Policy’ link (3rd link down) which takes you to the ‘Legislation and Policy’ webpage. Once on the ‘Legislation and Policy’ webpage, select 'Electrical Engineering' located under the ‘Engineering and Maintenance Policy’ section located on the centre of the page. The ‘Manual of Infrastructure Engineering – Electrical’ is found under the heading of Defence Policy, located on the left hand side of the page.

SPECIFIC REQUIREMENTS FOR EHA AND REA

1.122 For the purpose of this procedure, further requirements for electrical installations for explosives areas are shown in:

a. Explosives Hazardous Areas (EHA) - Annex C

b. Restricted Electrical Areas (REA) - Annex D

Annexes:

A. List of Related Standards, Codes of Practice and Publications

B. Explosives Areas Classifications Flow Chart

C. Explosives Hazardous Areas (EHA)

D. Restricted Electrical Areas (REA)

E. Electrical Non-Conformance Dispensation

F. Explosives Circuit Test Equipment and Portable Firing Equipment

G. Inspections and Test Periods

ANNEX A

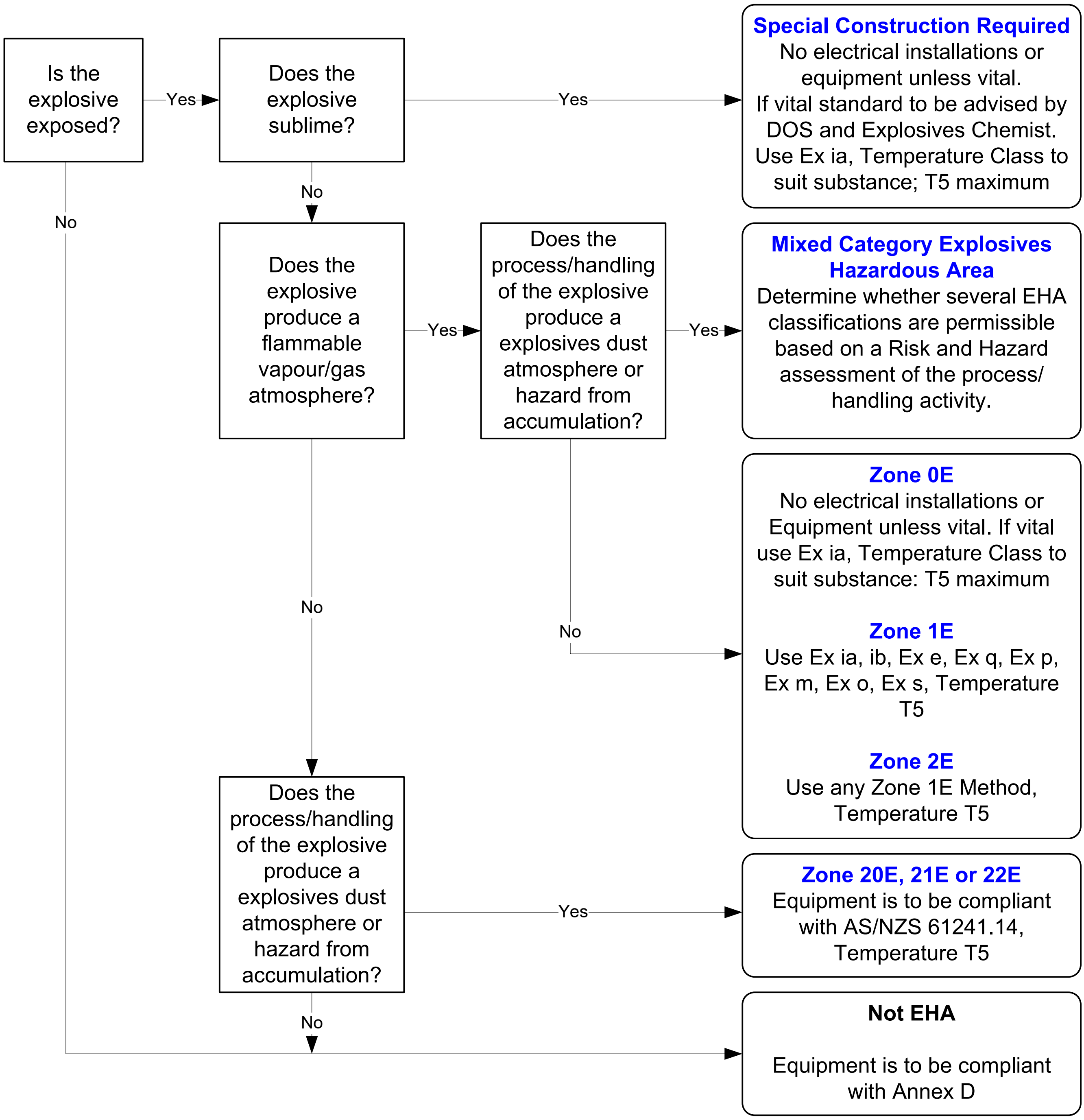
LIST OF RELATED STANDARDS

Australian Standards (AS) and Australian/New Zealand Standards (AS/NZS)

AS/NZS 1020	The control of undesirable static electricity
AS/NZS 1026:2004	Electric cables – Impregnated paper insulated – For working voltages up to and including 19/33 (36) kV
AS 1049	Telecommunications cables – Insulation, sheath and jacket
AS 1319	Safety signs for the occupational environment
AS 1332	Conveyor belting – Textile reinforced
AS 1334	Methods of testing conveyor and elevator belting Part 9 – Determination of electrical resistance of conveyor belting
AS/NZS 1680	Interior and workplace lighting Part 2.4 – Industrial tasks and processes
AS/NZS 1768	Lightning protection
AS 1915	Electrical equipment for explosive atmospheres – Battery operated vehicles
AS/NZS 2053	Conduits and fittings for electrical installations
AS/NZS 2067	Substation and High Voltage installations exceeding 1 kV ac
AS/NZS 2210	Safety, protective and occupational footwear
AS 2293.1	Emergency escape lighting and exit signs for buildings – System design, installation and operation
AS/NZS 2293.2	Emergency evacuation lighting for buildings – Inspection and maintenance
AS/NZS 3000	Electrical installations – Known as the Wiring Rules.
AS/NZS 3008.1.1	Electrical installations – Selection of cables
AS/NZS 3100	Approval and test specification – General requirements for electrical equipment
AS 3111	Approval and test specification – Miniature overcurrent circuit breakers
AS/NZS 3190	Approval and test specification – Residual current devices (current operated earth leakage devices)
AS/NZS 3191	Electric flexible cords
AS/NZS 3439	Low-voltage switchgear and control gear assemblies
AS/NZS 3760	In service safety inspection and testing of electrical equipment
AS/NZS 3800	Electrical equipment for explosive atmospheres – Repair and overhaul
AS 4254.2	Ductwork for air-handling systems in buildings – Rigid duct
AS/NZS 4761.1	Competency for working with Electrical equipment in Hazardous Areas

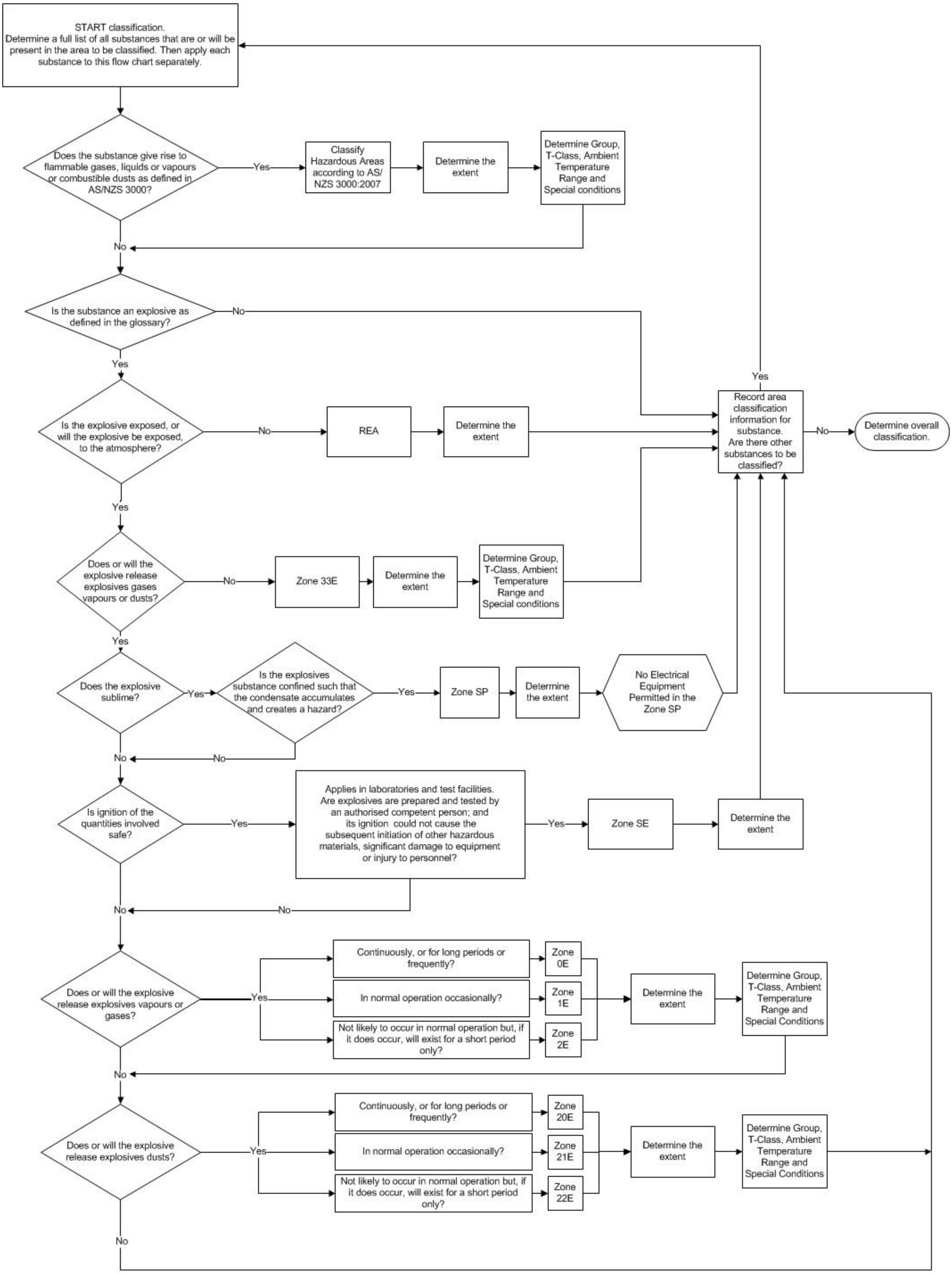
ANNEX A

AS/NZS 5000.1	Electric cables – Polymeric insulated – For working voltages up to and including 0.6/1 (1.2) kV
AS/NZS 60079.0	Explosive atmospheres – Equipment – General requirements
AS/NZS 60079.2	Explosive atmospheres – Equipment protection by pressurized enclosure ‘p’
AS/NZS 60079.5	Explosive atmospheres – Equipment protection by powdered filling ‘q’
AS/NZS 60079.6	Explosive atmospheres – Equipment protection by oil immersion ‘o’
AS/NZS 60079.7	Explosive atmospheres – Equipment protection by increased safety ‘e’
AS/NZS 60079.10.1	Explosive atmospheres – Classification of areas – Explosive gas atmospheres
AS/NZS 60079.10.2	Explosive atmospheres – Classification of areas – Combustible dust atmospheres
AS/NZS 60079.11	Explosive atmospheres – Equipment protection by intrinsic safety ‘i’
AS/NZS 60079.14	Explosive atmospheres – Explosive atmospheres - Design selection, erection and initial inspection
AS/NZS 60079.17	Explosive atmospheres – Electrical installations inspection and maintenance
AS/NZS 60079.18	Explosive atmospheres – Equipment protection by encapsulation ‘m’
AS/NZS 60079.25	Explosive atmospheres – Intrinsically safe electrical systems
AS/NZS 60079.28	Explosives atmospheres – Protection of equipment and transmission systems using optical radiation
AS/NZS 60079.31	Explosive atmospheres – Equipment dust ignition protection by enclosure ‘t’
AS/NZS 60079.33	Explosives atmospheres – Equipment protection by special protection ‘s’
AS 60269.1	Low – voltage fuses – General requirements
AS 60529	Degrees of protection provided by enclosures (IP Code)
AS/NZS 60598.1	Luminaires – General requirements and tests
AS/NZS 61000.3	Electromagnetic compatibility (EMC) limits
AS/NZS 61008.1	Residual current operated circuit-breakers without integral overcurrent protection for household and similar uses (RCCBs)
AS/NZS CISPR 22	Information technology equipment - Radio disturbance characteristic - Limits and methods of measurement


Is the explosive exposed?
Yes
No
Does the explosive sublime?
Yes
No
Special Construction Required
No electrical installations or equipment unless vital.
If vital standard to be advised by DOS and Explosives Chemist.
Use Ex ia, Temperature Class to suit substance; T5 maximum
Does the explosive produce a flammable vapour/gas atmosphere?
Yes
No
Does the process/handling of the explosive produce a explosives dust atmosphere or hazard from accumulation?
Yes
No
Mixed Category Explosives Hazardous Area
Determine whether several EHA classifications are permissible based on a Risk and Hazard assessment of the process/ handling activity.
Zone 0E
No electrical installations or Equipment unless vital. If vital use Ex ia, Temperature Class to suit substance: T5 maximum
Zone 1E
Use Ex ia, ib, Ex e, Ex q, Ex p, Ex m, Ex o, Ex s, Temperature T5
Zone 2E
Use any Zone 1E Method, Temperature T5
Does the process/handling of the explosive produce a explosives dust atmosphere or hazard from accumulation?
Yes
No
Zone 20E, 21E or 22E
Equipment is to be compliant with AS/NZS 61241.14, Temperature T5
Not EHA
Equipment is to be compliant with Annex D

ANNEX B

EXPLOSIVES AREA CLASSIFICATIONS



NOTE – area is a three-dimensional region or space.

ANNEX C

EXPLOSIVES HAZARDOUS AREAS

Scope

1. This Annex details the requirements for electrical, telecommunications and security systems in EHA.

Minimal installation

2. With a high focus on safety required in EO areas, the minimisation of electrical equipment installed in EHAs is paramount. This is often accomplished by the use of remote mechanical and hydraulic drives, pneumatically operated equipment or locating light fittings to be externally mounted and illuminate through windows. When this is impractical the need to supply, install and maintain electrical equipment and installations is an integral safety requirement for EO areas.

3. Accordingly, electrical and control equipment shall be located outside of the EHA wherever practical.

4. Installations shall be designed and installed to minimise the need for maintenance access into the EHA. All equipment and materials installed within an EHA should be designed to provide ease of access for inspection and maintenance activities.

Electrical non-conformance dispensation and engineering solutions

5. Where equipment is not available with ANZEx or IECEx certification, it may be possible to use an engineering solution using other control measures that provide an equivalent level of safety. This will require a competent person to produce a risk assessment of the engineering solution with fully documented supporting evidence. This shall be submitted to DOS with the application for Electrical Non-Conformance Dispensation. Refer to Annex E of Regulation 6.3, Procedure 1, for an electrical non-conformance dispensation pro-forma.

6. In undertaking Risk Assessments of non-conforming installations, relevant criteria including the following aspects shall be taken into consideration using appropriate risk and hazard assessment techniques:

   a. The properties of the explosive materials.

   b. The type and frequency of operations.

   c. The relevant EHA classification.

   d. Operational requirements.

   e. The type and standard of the electrical installation.

   f. The availability of certified equipment.

   g. Specific maintenance and housekeeping requirements.

Material restrictions

7. In all EHA the following precautions must be observed to avoid risk of incentive sparks:

   a. Exposed ferrous articles must be painted or galvanised.

   b. Exposed aluminium alloys used are not to contain more than 6% Magnesium.

   c. Aluminium paint is not to be used.

   d. Nonconductive plastic materials shall not be used in areas that require a conductive regime as per Regulation 6.3 Procedure 2.

8. In areas where unpackaged Ammonium Nitrate is handled the following precautions must be observed:

a. Ferrous fitments must have a suitable protective coating to prevent the ammonium nitrate reacting with the ferrous material.

b. Exposed aluminium alloys, exposed copper and exposed copper alloys are to be avoided.

Documentation requirements for Explosives Hazardous Areas

9. EHA Verification Dossiers shall be prepared for electrical plant, equipment and installations within an EHA.

10. Verification Dossiers can be in electronic and/or hard copy form and must be readily accessible from the premises. Documentation contained within these verification dossiers shall include the information required by clause 4.2 of AS/NZS 60079.14:2009 and clauses 4.1 and 5.3.2 of AS/NZS 60079.17. Documentation shall also include:

a. Classification report and drawings of the EHA.

b. Equipment, wiring and accessories selection.

c. Records of all personnel involved in the classification, selection, installation, testing, auditing and commissioning including relevant qualifications and experience.

d. Design certification.

e. Manufacturer’s installation instructions.

f. Records of inspections and inspection procedures.

g. Records of tests and test procedures.

h. Photographic records.

i. Records of commissioning and commissioning procedures.

j. As-built drawings including those showing circuit identification.

k. Operating and maintenance instructions for the EHA electrical installations including a recommended maintenance schedule.

l. Construction certificates and certification.

Qualifications and competency

11. Competent and experienced persons/companies must be engaged to undertake EHA design, selection, installation, inspection, testing, maintenance, overhaul and repair of electrical equipment. As a minimum requirement they shall be competent to carry out these activities in hazardous areas as defined in AS/NZS 3000:2007. Guidance for competencies in hazardous areas is provided in AS/NZS 4761.1 - *Competencies for Working with Electrical Equipment in Hazardous Areas (EEHA)*. Appropriate continuing education and training should be undertaken by personnel on a regular basis. In addition they must understand the special properties of the explosives materials which are or may be present. The persons with the specific competencies must be the persons who carry out the specific task(s). It is not sufficient for a competent person to check the work of a person without the required competencies.

CABLING AND WIRING SYSTEMS

General

12. Wiring systems are not permitted in Zone SP unless the risk posed by explosives that may sublime/evaporate and subsequently condense in (or upon) electrical/electronic wiring is considered.

13. Wiring systems as permitted for non-hazardous areas in accordance with AS/NZS 3000 are permitted for Zone SE installations.

14. Types of wiring systems permitted in explosive hazardous areas (other than Zone SE and Zone SP) for the fixed installation wiring up to the point of final flexible connection to equipment are as follows:

a. Steel Wire Armoured (SWA) with insulating outer sheath.

b. Insulated and sheathed, single core or multi-core cables installed in a screwed steel conduit system. Conductors shall be stranded copper conductors.

c. Mineral Insulated Metal Sheathed (MIMS) cables with insulating outer sheath.

d. Paper Insulated, Lead sheathed SWA cables.

e. Insulated and sheathed cables with stranded conductors enclosed in metal trunking.

15. Additional types of wiring systems permitted in explosive hazardous areas (other than Zone SE and Zone SP) for the final connections to equipment are as follows:

a. Heavy duty sheathed flexible cable.

b. Sheathed cable in heavy duty flexible steel conduit with insulating outer sheath.

16. All power and control cabling installed in EHAs shall be minimum 0.6/1 kV, V75 grade insulation. Conductors for power circuits, excluding MIMS, shall be minimum 2.50 mm^2 multi-strand copper and control circuits 1.5 mm^2 multi-strand copper.

17. MIMS cables and accessories are to be 1000V heavy duty grade with an insulating outer sheath.

18. Steel wire armoured and sheathed cables are to comply with AS/NZS 5000.1.

19. Additional protection against mechanical damage is to be provided where necessary.

Terminating and jointing

20. All power and control cables shall be run in one continuous length between supply and load terminations. Control cables marshalling junction boxes may be used where practical.

21. The terminating and jointing of wiring shall be:

a. The requirements for Zones 0E, 1E and 2E shall be the corresponding requirements for Zones 0, 1 and 2 in AS/NZS 60079.14.

b. The requirements for Zones 20E, 21E and 22E shall be the corresponding requirements for Zones 20, 21 and 22 in AS/NZS 60079.14.

c. The requirements for Zone 33E shall be the corresponding requirements shown in Table 1C-2.

d. Electrical installations are not permitted in Zone SP.

e. The requirements for Zone SE shall be the corresponding requirements for non-hazardous areas in accordance with AS/NZS 3000.

f. The enclosures for terminating and jointing of wiring shall have corresponding methods of protection permitted in Table 1C-1 - Selection of Types of Explosion Protection Techniques, Maximum Surface Temperature, Group and IP Rating for Electrical Equipment in EHA (Select link for details).

22. All cables shall be fitted with cable glands at entry points to switchboards, control panels and devices.

23. Cable glands shall be suitable for the Zone of the EHA in which they are used and shall maintain the protection rating of the enclosure.

24. Bunching of conductors may give rise to high temperatures which may exceed the T-Class and/or damage the insulation and shall be avoided.

Cable identification

25. Cables shall be identified using a cable identification system fixed longitudinally to the cable with the cable number and or letters as required.

26. Tags shall be provided:

a. At each end of all multi-core cables.

b. On each side of a wall penetration.

c. On cables entering or leaving trenches or ducts.

d. At each 30 metres of cable length where two or more cables run together.

27. Control cable core shall be identified at every terminal by numbered “slip-on” plastic ferrules, the numbers corresponding to connection diagrams. Ferrules shall be of the appropriate size for the cable and shall be tight fitting over the insulation.

Cable fixing

28. Except where cables are installed inside an enclosure they shall be neatly secured to cable ladder, tray and structures using cable ties or non-corrosive saddles at a maximum of 2 metre centres on horizontal runs and 1 metre centres on vertical runs. Push-on or Clip-on cable fixing clips or saddles are not acceptable. Common saddle or cable ties may be used for grouped cables where appropriate.

Armoured cables – earthing

29. The metal armouring of a cable shall be earthed at the point of origin of the circuit.

Cable penetrations – seals

30. Cable penetrations through ceilings, floors and walls at a change of zone shall be sealed to prevent transfer of dust or vapour across the boundary. The method of sealing shall be such that a smooth cavity free surface finish is present in the EHA.

DUCTS/CONDUITS – ALL VOLTAGES

General

31. Conduits shall be:

a. Heavy duty seamless galvanised steel; and/or

b. Heavy duty flexible steel conduit with insulating outer sheath for final flexible connections.

32. Conduit systems are not permitted in Zone SP.

33. The requirements for Zone SE shall be the corresponding requirements for non-hazardous areas in accordance with AS/NZS 3000.

34. The use of corrugated conduit is not permitted in EHAs.

35. Conduit shall be provided with a conduit sealing device where it enters or leaves the EHA, to prevent the transmission of gases, vapours or dusts from the EHA to the non-EHA. There shall be no union, coupling or other fittings between the sealing device and the EHA boundary. Conduit sealing devices shall seal around the outer sheath of the cable where the cable is effectively filled or around the original conductors inside the conduit. The sealing mechanism shall be such that it does not shrink on setting and sealing mechanisms shall be impervious to, and unaffected by, chemicals found in the EHA. The method of sealing shall be that a smooth cavity free surface finish is present in the EHA.

36. Ducts shall be sealed to prevent the ingress of explosive dusts into the ducting.

37. Wiring in intrinsically safe circuits does not require mechanical protection through the use of conduits excepting where wiring may be exposed to mechanical damage.

38. Conduits and conduit fittings shall comply with the appropriate parts of the AS/NZS 2053 series and shall be suitable for the classification of the area. The minimum size conduit permitted shall be 20 mm diameter and for mechanical strength, the minimum length of thread for the screwed conduits and pipe joints shall have a minimum of 5 full thread widths engaged.

Installation

39. Solid and inspection type tees and elbows are not permitted. Draw-in boxes shall be used where the conduit run exceeds 15 metres or includes more than two (2) right angle bends.

40. Where exposed in Zone 20E, 21E, 22E EHAs, conduit and duct shall be surface run clear of walls and ceilings at a distance suitable for cleaning accumulated dust from the surfaces. Conduit shall be fixed with a minimum of 12 mm clearance from a wall and be suitably supported by solid backed splayed saddles.

41. Joints in conduit runs shall be kept to a minimum and shall be made with couplers suitably rated for the EHA. Each length of conduit shall be tightly screwed into the couplers and the whole system shall be mechanically and electrically continuous.

42. All metallic conduits shall be bonded to the bonding bar or the electrical earthing system at the electrical switchboard. Bonding shall be achieved with an earth clamp. All paint and other electrical insulating material shall be removed from the outside of the conduit prior to the application of the earth clamp. Metallic conduits installed with cables shall not be connected directly to the anti-static system conductors.

CABLE LADDER AND CABLE TRAY – ALL VOLTAGES

Uses

43. Cable ladders and cable trays may be used for support of cables throughout EHAs, for cable types which do not require further mechanical protection (i.e. SWA or intrinsically safe wiring (IS).

Types and installation

44. Cable ladders and cable trays shall be hot dipped galvanised steel, run horizontally or vertically.

45. All cable ladders and cable trays installed in Zone 20E, 21E, 22E EHAs shall be installed in the vertical plane, spaced from walls and ceilings at a distance suitable to allow cleaning accumulated dust from surfaces. Clearance from the ceiling shall be a minimum of 50 mm. Cable ladders and trays shall only be installed in Zone 20E, 21E EHAs where essential, due to the potential for accumulation of dust of explosives on the cable ladder. Whenever cable ladders or trays are used in Zone 20E, 21E specific provision shall be made in the Operating Instructions for the area to ensure that the cable ladder or tray is cleaned on a regular basis.

Earthing

46. All cable ladders and cable trays installed in EHAs shall be earthed to the equipotential bonding system where this is present otherwise to the Main Switchboard earth bus. Cable ladders and trays shall be electrically continuous along their entire length.

ANNEX C

ELECTRICAL EQUIPMENT, HEATING, VENTILATION AND AIR CONDITIONING

Certification

47. All EHA located electrical equipment shall be certified to comply with ANZEx or IECEx certification schemes. This applies to all electrical equipment, materials handling equipment (including overhead cranes), fire protection, intruder alarm, access control, CCTV, communications equipment, instrumentation and electronic equipment including fixed, portable, transportable and personal. It applies to all EHA installations, permanent or temporary at all voltages.

Note:

Personal equipment includes watches, hearing aids, mobile phones, remote controls, test equipment, torches, radios, computers and batteries.

Permitted Types of Explosion Protection Techniques

48. The selection of AS/NZS 3000 hazardous area electrical equipment is based on flammable gases, liquids or vapours or combustible dusts becoming explosive only when mixed with air in the correct proportions and the electrical equipment becoming ignition capable. The explosive materials are explosive at all times in any quantity so consideration must be given firstly to the consequences of ignition of the materials. Where the use of electrical equipment cannot be avoided, equipment with the highest Equipment Protection Level available shall be considered.

49. Electrical equipment does not exist which is specifically designed and certified for use in explosives hazardous areas. Electrical equipment does exist for use in AS/NZS 3000 hazardous areas. Based on the ease of ignition by electrical spark and hot surface characteristics of explosives it is appropriate to use some of the Group II and Group III certified electrical equipment in EHA. The types of Explosion Protection Techniques, Maximum Surface Temperature and Degrees of Protection by Enclosure permitted in each EHA are tabulated in Table 1C-1.

50. Groups permitted for types of Explosion Protection Techniques:

a. Zones 0E, 1E or 2E - Group II or IIIC equipment for all permitted types of Explosion Protection Techniques excluding Intrinsic Safety.

b. All Zones - Group IIC Intrinsically Safe equipment where the Ignition Energy Greater than 20 µJ.

c. Zones 20E, 21E and 22E - Group IIC permitted Intrinsically Safe equipment or Group IIIC permitted Intrinsically Safe equipment where the Ignition Energy Greater than 1 mJ.

d. Zones 20E, 21E or 22E - Group IIIC for all permitted types of Explosion Protection Techniques excluding Intrinsic Safety.

e. Zone 33E - Groups IIA, IIB, IIC or IIIC for all permitted types of Explosion Protection Techniques provided the exposed explosive will not come into contact with the equipment.

f. Coincident Zones - Groups permitted in the above for all of the Coincident Zones.

51. Permitted Ambient Temperature of the equipment shall be appropriate for the ambient temperature range for each location taking into account temperature influence from other factors e.g. the process temperature or exposure to solar radiation and global warming.

52. The equipment shall be suitable for the Special Conditions such as electromagnetic radiation, vibration, corrosion, chemical influences, high levels of ultra violet light, moisture, chemical influences, mechanical impact and avoidance of light alloys.

53. The risk posed by explosives that may sublime/evaporate and subsequently condense in (or upon) electrical/electronic equipment shall be considered.

54. Certified equipment shall not be modified.

55. Self-contained hand lamps and torches complying with the protection requirements indicated in Table 1C-1 shall not to be used in such a way that the light is focused on to or can appreciably heat the EO. In areas where regulations require that non-ferrous materials are to be used, hand lamps and torches must also comply with this requirement.

Installation

56. The permitted types of explosion protection are tabulated in Table 1C-1. The installation shall be installed to AS/NZS 60079.14 Zones shown in the Table 1C-2 below. In addition to those requirements:

a. Flameproof (Ex d) equipment is not permitted in explosives hazardous areas. Flameproof equipment has not been designed, tested nor certified for use with explosive materials. Explosive materials have much greater rates of rise of pressure and maximum pressures than those for which the method of protection was designed.

b. Type of Protection 'n' (Ex n, Ex nA, Ex nC, Ex nL and Ex nR) are not permitted in explosives hazardous areas because its integrity is considered inadequate for explosives.

c. Oil Immersion (Ex o) is not permitted in explosives hazardous areas because its method of protection is incompatible for explosives.

d. Powder Filling (Ex q) equipment is not permitted in explosives hazardous areas because the protection technique has not been designed, tested nor certified for use with explosive materials. It is not known whether the technique would be effective at quenching explosives gases and/or vapours.

e. Special Protection (Ex s, Ex sa, Ex sb and Ex sc) is not permitted in explosives hazardous areas. Special Protection equipment cannot comply in full with any of the other recognised types of protection. Special Protection relies on the manufacturer establishing the criteria for verification rather than the criteria being published in one of the Standards.

f. Ventilation (Ex v) is not permitted in explosives hazardous areas because explosive gases and vapours are explosive in any proportion with air. It is not possible to dilute explosive gases and vapours to prevent ignition.

EHA Zones	**Install to AS/NZS 60079.14 Requirements for**
Zone 0E	Zone 0 (Ga)
Zone 1E	Zones 0 or Zone 1 (Ga or Gb)
Zone 2E	Zone 0, Zone1 or Zone 2 (Ga, Gb or Gc)
Zone 20E	Zone 20 for electrically conductive dust[1] (Da)
Zone 21E	Zones 20 or Zone 21 for electrically conductive dust[1] (Da or Db)

Zone 22E	Zone 20, Zone 21 or Zone 22 for electrically conductive dust[1] (Da, Db or Dc)
Zone 33E	Zone 0, Zone1, Zone 2, Zone 20, Zone 21 or Zone 22 (Ga, Gb, Gc, Da, Db or Dc)
Zone SE	Certified equipment not required
Zone SP	Electrical installations are not permitted without risk assessment

Table 1C-2 Zone Installation Requirements

Note:

For Zones 20E, 21E and 22E the ingress protection of certified equipment enclosures shall comply with the requirements for electrically conductive dusts to ensure that explosives dust will not enter the equipment enclosures.

Enclosures

57. Exteriors of enclosures shall be selected for ease of cleaning. Crevices and dust traps are to be avoided. Ferrous metal enclosures shall be corrosion protected and all exteriors are to have a smooth, hard, finish.

Heating appliances

58. Heating appliances in EO areas are to be permanently installed. All electrically operated equipment associated with the heating appliance shall be located outside the EHA or in a Plant Room unless it complies with the protection requirements of Table 1C-1. Portable heaters are not permitted in EO areas.

59. Electrically heated floors, walls and ceilings are not permitted in any EHA areas.

Air conditioning and ventilation systems

60. Temperature and humidity control is typically provided for process requirements and operator comfort. All electrically operated equipment associated with air conditioning systems shall be located outside the EHA or in a separate Plant Room unless it is a self- contained unit (similar to a fan coil unit or split system indoor unit) within the EHA and certified to comply with the protection requirements of Table 1C-1. The preferred arrangement is to locate all equipment outside the EHA and provide suitable barriers/precautions for services penetrations into the EHA.

61. Ductwork associated with the air-conditioning and ventilation systems must be effectively sealed air-tight at transverse joints, longitudinal seams and duct wall penetrations and maintained with air-tight sealing for the life of the installation. Sealing of ductwork shall be to AS 4254.2 Seal Class A and shall apply equally to positive and negative pressure modes.

62. The air conditioned EHA shall be maintained under negative pressure (50 Pa minimum) with respect to the area outside the EHA when external access doors are closed. An exhaust air filter shall be provided upstream of the exhaust air fan to prevent active material (other than vapours and gasses of explosives, solvents and the like) from leaving the EHA. Filters shall be installed to prevent leakage of active material around their perimeter. An air filter shall be provided on the air conditioning system upstream of the air handling unit to filter the supply airstream of external particulate contaminants.

63. The exhaust air fan motor shall preferably be located outside the exhaust airstream. The impeller located in the exhaust airstream must be anti-static and non-sparking. Alternatively the

motor which is located within the airstream shall be certified with the protection requirements of Table 1C-1 and the impeller located in the exhaust airstream must be anti-static and non-sparking.

64. Air conditioning and ventilation duct penetrations through fire rated barriers shall comply with the requirements Chapter 15 of the MFPE.

65. Conditioned air supply from a non EHA electrically certified unit located outside the EHA shall be once through (i.e.100% outside air with no recirculated air).

66. Recirculation air conditioning systems within the EHA shall not use electric element heaters. All other heater types shall limit heater surface temperature to comply with the T-Class of the EHA.

67. Humidity control shall be provided preferably by a humidifier (and dehumidifier if necessary) located at the air conditioning unit outside the EHA. Alternatively where the humidifier and air conditioning unit are located within the EHA, they shall be certified with the protection requirements of Table 1C-1.

68. Air conditioning and ventilation systems shall take into consideration:

a. The properties of the explosives materials.

b. The type and frequency of operations.

c. The extent of dusts of explosives in the air.

d. The size of dusts of explosives particles.

e. Concentrations of dust on the filters.

f. Specific maintenance and housekeeping requirements associated with the air conditioning and ventilation systems.

69. Within the EHA:

a. Fan impellers in contact with the air stream shall be of non-sparking and non-static construction.

b. All ductwork shall be sheet metal and appropriately bonded and earthed.

c. All pipework shall be metal and appropriately bonded and earthed.

d. Documented procedures for the inspection, cleaning, decontamination of the air conditioning and ventilation systems and removal of explosive waste shall be established and implemented.

70. Air conditioning, ventilation, humidity and pressure control systems and sensors shall be certified in accordance with the protection requirements of Table 1C-1.

Inspection, testing and maintenance of electrical installations in EHA including commissioning

71. The types of protection permitted in EHA electrical installations shall be inspected, tested and commissioned in accordance with AS/NZS 3000, AS/NZS 60079.14 and AS/NZS 60079.17.The results of these inspections and tests shall be recorded and retained in the verification dossier.

72. All work undertaken during planned inspection; testing and maintenance shall be carried out in accordance with the EO area work instructions, procedures and permit requirements.

73. Testing of equipment in EHAs must be carried out when the area is emptied of explosives unless the test equipment is suitable for use within the specific EHA.

74. The frequency of inspections of EHA electrical equipment is to be in accordance with Annex G. Once the inspection frequency has been established, the installations shall be subjected to interim sample inspections to support or modify the established inspection intervals.

75. Test and provide evidence of compliance of the earthing, lightning protection and static earthing systems including results of continuity and resistance measurements are to be provided and recorded.

76. Provide a record of all measurements taken, degree of uncertainty, test method and instrumentation used. Record the serial numbers and calibration dates of all of the instruments used.

77. Photographic evidence is to be provided of:

a. Location and depth of burial of all underground electrical services including earth ring conductors.

b. Any important elements "built-in" and inaccessible for later inspection.

c. Separation of static earthing systems and electrical services from lightning protection down conductors.

d. Equipotential bonding of the structure to the lightning protection system.

e. Sealing of all fire rated penetrations.

78. The locations to which the photographs relate shall be shown on the as-built drawings.

79. Tests and inspections shall include but not be limited to the safe and satisfactory operation of RCD protection, emergency evacuation lighting, artificial lighting, lightning protection, electrical protection system earthing, static earthing, switchboards, integrity of penetration sealing, integrity of enclosures, integrity of insulation, integrity of fixings and supports, tightness of connections and verification of electrical installation touch temperature limits. Due to the nature of the tests and test equipment, it may be necessary to advise that tests of the electrical installation be carried out when the area is emptied of explosives.

80. The integrity of degrees of enclosure of all electrical equipment and enclosures is to be verified at completion. Verify adequate ventilation/shading or other treatment as required to maintain ambient temperatures inside enclosures to within the rated operating limits of the enclosed equipment. Include details in the Restricted Electrical Area Dossier.

81. Installations shall pass periodic inspections prescribed in this instruction to verify the installations continue to be safe.

82. A record of the various metals that have been bonded to the lightning protection system is to be provided and included in the dossier. Verify the compatibility of dissimilar metals and treatments used.

Compliance Audit

83. The classification, design, selection, installation, documentation, inspection and testing shall be audited for compliance with this Procedure by a person not otherwise involved with the project and who holds appropriate competencies.

Withdrawal from service

84. Where electrical equipment is removed for maintenance, any exposed conductors which remain, should be mechanically secured and electrically isolated in a manner to prevent the occurrence of any unsafe condition. In addition to the standards, the exposed conductors should be fitted within an appropriate enclosure to prevent contamination from the active materials.

85. Environmental conditions should be considered. In addition any products or equipment used during maintenance activities shall be compatible with the process environment in which they are to be used.

Overhaul and repair

86. The overhaul and repair of certified explosion protected electrical equipment shall be in accordance with AS/NZS 3800. Work shall be carried out by either the manufacturer or a service facility registered for the particular explosion protection technique.

ANNEX C

Tables

Table 1C-1 - Selection of Types of Explosion Protection Techniques, Maximum Surface Temperature, Group and IP Rating for Electrical Equipment in EHA. Select link for details.

Table 1C-2 – Zone Installation Requirements.

TYPE OF PROTECTION	Ex Code	Zone 0E	Zone 1E	Zone 2E	Zone 20E	Zone 21E	Zone 22E	Zone 33E	Zone SE	Zone SP
Increased safety	Ex e	**X**	**II**	**II**	**X**	**X**	**X**	**II**	Standard equipment permitted	Electrical equipment not permitted without risk assessment Note 7
Intrinsically safe	Ex ia	**II**	**II**	**II**	**II or III**	**II or III**	**II or III**	**II or III**		
Intrinsically safe	Ex ib	**X**	**II**	**II**	**X**	**II or III**	**II or III**	**II or III**		
Intrinsically safe	Ex ic	**X**	**X**	**II**	**X**	**X**	**II or III**	**II or III**		
Encapsulation	Ex ma	**II**	**II**	**II**	**III**	**III**	**III**	**II or III**		
Encapsulation	Ex m or Ex mb	**X**	**II**	**II**	**X**	**III**	**III**	**II or III**		
Encapsulation	Ex mc	**X**	**X**	**II**	**X**	**X**	**III**	**II or III**		
Pressurised rooms	Ex p	**X**	**II**	**II**	**X**	**X**	**X**	**NA**		
Pressurised enclosures	Ex p	**X**	**II**	**II**	**X**	**III**	**III**	**NA**		
Pressurised enclosures	Ex pD	**X**	**X**	**X**	**X**	**III**	**III**	**NA**		
Pressurised enclosures	Ex px or Ex py	**X**	**II**	**II**	**X**	**X**	**X**	**NA**		
Pressurised enclosures	Ex pz	**X**	**X**	**II**	**X**	**X**	**X**	**NA**		
Dust Ignition Protection (DIP)	DIP 20*	**X**	**X**	**X**	**III Note 1**	**III**	**III**	**III**		
Dust Ignition Protection	DIP 21*	**X**	**X**	**X**	**X**	**III**	**III**	**III**		
Dust Ignition Protection	DIP 22*	**X**	**X**	**X**	**X**	**X**	**III**	**III**		
Dust-Tight	Ex tD A20*	**X**	**X**	**X**	**III Note 1**	**III**	**III**	**III**		
Dust-Tight	Ex tD A21*	**X**	**X**	**X**	**X**	**III**	**III**	**III**		
Dust-Tight	Ex tD A22*	**X**	**X**	**X**	**X**	**X**	**III**	**III**		
Dust-Tight	Ex tD B20*	**X**	**X**	**X**	**III Note 1**	**III**	**III**	**III**		
Dust-Tight	Ex tD B21*	**X**	**X**	**X**	**X**	**III**	**III**	**III**		
Dust-Tight	Ex tD B22*	**X**	**X**	**X**	**X**	**X**	**III**	**III**		
DIP by Enclosure	Ex ta*	**X**	**X**	**X**	**III Note 1**	**III**	**III**	**III**		
DIP by Enclosure	Ex tb*	**X**	**X**	**X**	**X**	**III**	**III**	**III**		
DIP by Enclosure	Ex tc*	**X**	**X**	**X**	**X**	**X**	**III**	**III**		
Flameproof	Ex d	Note 6	Note 6	Note 6	Note 6	Note 6	Note 6	Note 6		
Non Sparking	Ex n	Note 6	Note 6	Note 6	Note 6	Note 6	Note 6	Note 6		
Oil Immersion	Ex o	Note 6	Note 6	Note 6	Note 6	Note 6	Note 6	Note 6		
Powder Filling	Ex q	Note 6	Note 6	Note 6	Note 6	Note 6	Note 6	Note 6		
Special Protection	Ex s	Note 6	Note 6	Note 6	Note 6	Note 6	Note 6	Note 6		
Ventilation	Ex v	Note 6	Note 6	Note 6	Note 6	Note 6	Note 6	Note 6		
Temperature Classification		Note 2	Note 2	Note 2	Note 3	Note 3	Note 3	Note 4		
Degree of Protection (Min) IP Rating (Note 5)		IP 2X	IP 2X	IP 2X	IP 6X	IP 6X	IP 6X	IP 2X		

Table 1C–1: SELECTION OF TYPES OF EXPLOSION PROTECTION TECHNIQUES, MAXIMUM SURFACE TEMPERATURE, GROUP AND IP RATING FOR ELECTRICAL EQUIPMENT IN EHA

INSTRUCTIONS – Refer to Procedure 1 Annex C Explosives Hazardous Areas for details.

LEGEND

X Equipment Type Not Permitted, II - Group II Equipment Permitted, III - Group III Equipment Permitted, * Equipment shall be suitable for electrically conductive dusts in each Zone.

NOTES

Note 1: Socket Outlets are not permitted in Zone 20E.

Note 2: Minimum Ignition Temperature of the explosives vapour or gases or 100˚ C (T5) whichever is the lower.

Note 3: Appropriate Maximum Surface Temperature shall be based on the lowest of the following temperatures:

(i) Minimum Ignition Temperature of the explosives dust less 50°C; or

(ii) 100°C whichever is the lower.

Note 4: Minimum Ignition Temperature of the explosives material less 50˚ C or 100˚ C (T5) whichever is the lower.

Note 5: The Ingress Protection of the equipment shall be determined by the location and be no less than the ratings shown in the table above.

Note 6: Ex d, Ex n, Ex nA, Ex nC, Ex nL, Ex nR, Ex o, Ex q, Ex s, Ex sa, Ex sb, Ex sc and Ex v are not permitted in EHA.

Note 7: The risk posed by explosives that may sublime/evaporate and subsequently condense in (or upon) electrical/electronic equipment shall be considered.

ANNEX D

RESTRICTED ELECTRICAL AREAS

General

1. A Restricted Electrical Area (REA) is a location in which EO is present but the explosive substances are not exposed to the atmosphere.

2. This section is for use by competent designers and sets minimum safety standards for REA. It builds upon requirements already contained in AS/NZS 3000:2007 *Wiring Rules*, requiring compliance with the *Wiring Rules* and applying additional restrictions on the installation to minimise the risk of excessive temperatures and fires within the EO area initiated by electricity.

3. Where the specific equipment is selected by others, the competent designer must verify that the selected equipment is suitable for the REA.

4. This document specifies how to minimise the risk of excessive temperatures and fires due to the use of electricity in EO REA. The reason for an REA is to avoid harm to people and to prevent damage to EO, property and the environment.

5. Reference and compliance is necessary to the following documents:

a. AS/NZS 3000.

b. Manual of Fire Protection Engineering (MFPE).

c. National Construction Code – Building Code of Australia (BCA).

d. Manual of Infrastructure Engineering – Electrical (MIEE).

Minimal installation of Electrical Equipment and Wiring in Explosive Ordnance Facilities

6. Only electrical and control equipment essential for the operations of the area shall be located in an REA. Accordingly, electrical and control equipment shall be located outside of the REA wherever practical.

7. Installations shall be designed to minimise the need for maintenance access into the REA. All equipment and materials installed within an REA shall be designed to provide ease of access for inspection and maintenance activities.

Safety Principles

8. Safe installation methods for REA are based on understanding and applying the requirements prescribed in Part 2: Installation practices - Sections 2 to 8 of AS/NZS 3000:2007 (Wiring Rules) plus additional restrictions required to protect the equipment and wiring from overheating as prescribed within this document. It is therefore necessary to read and understand the Wiring Rules when applying this document.

9. Wiring Rules Part 1: *Scope, Application and Fundamental Principles* shall also apply with the exceptions of Section 1.5.4.5 *Protection by obstacles* and Section 1.5.4.6 *Protection by placing out of reach*. These two sections of the Wiring Rules rely on protection from direct contact by restricting access to competent persons. These sections are not applicable because exposed live parts are prohibited in REA.

10. At the design stage in exceptional circumstances, the designer may apply for dispensation to achieve compliance utilizing the provisions under Section 1.9.4 *Compliance by specific design and installation* of the Wiring Rules.

11. The installation is required to be selected, installed, inspected, tested, operated, maintained, overhauled and repaired to maintain protection from overheating due to the use of electricity in accordance with the Wiring Rules.

12. It is necessary to control access by personnel and equipment to the REA to preserve the safety of the installation.

Electrical non-conformance dispensation and engineering solutions

13. Where the designer finds it necessary to achieve compliance with the requirements of AS/NZS 3000 by utilizing the provisions under Section 1.9.4 *Compliance by specific design and installation* of the Wiring Rules refer to the MIEE for guidance.

14. Where the prescriptive requirements over and above the requirements of AS/NZS 3000 of this Annex cannot be met, it may be possible to use an engineering solution using other control measures that provide an equivalent level of safety. This will require a competent person to produce a risk assessment of the engineering solution with fully documented supporting evidence. This shall be submitted to DOS with the application for Electrical Non-Conformance Dispensation. Refer to Annex E for an electrical non-conformance dispensation pro-forma.

15. In undertaking risk assessments of non-conforming installations, relevant criteria shall be taken into consideration using appropriate risk and hazard assessment techniques.

Competencies

16. Those undertaking design, installation, maintenance and overhaul work in REA shall be competent in the application of the *Wiring Rules*. Due to the higher risk nature of the installations covered by this standard, it is not acceptable for only supervision or inspection of the non-competent by competent persons.

17. A list of the competent persons and evidence of competence shall be provided prior to the activity being carried out and shall be recorded in the REA dossier (refer to paragraph 28 for an explanation of REA dossier).

Dispensations, Compliance by Specific Design and Engineering Solutions

18. Dispensation cannot be provided for non-compliance with the requirements of the Wiring Rules. Compliance by specific design and installation in accordance with Part 1 of the Wiring Rules may be considered subject to the conditions already outlined in Section 1 of this document and the requirements of the MIEE.

19. Dispensation from the prescriptive requirements of this document (where the requirements fall outside the requirements of the Wiring Rules) may be necessary for special installations. A Dispensation application shall be in the form of an engineering solution which achieves equivalent or better level of safety (to a degree that is reasonably practicable) and may be granted by the Director of Ordnance Safety (DOS) subject to consideration and possible conditions. This will require a competent person to produce a risk assessment of the engineering solution with fully documented supporting evidence. This shall be submitted to DOS with the application for Electrical Non-Conformance Dispensation. Refer to Annex E for an electrical non-conformance dispensation pro-forma.

Hot Work Permits

20. A hot work permit shall be issued before any work or activity not complying with the REA requirements is permitted while EO is in the REA. Any application for a hot work permit shall be accompanied by a Job Safety Analysis (JSA) from the competent person who will carry out the work. The JSA shall detail the exact nature and procedures involved in the works including risk assessment and management. Hot work permits may only be granted by the person in control of the area for the specific work, methods and the limited period described on the permit. Any required variation to the conditions shall require a new hot work permit.

Signage

21. Provide signage on all points of entry to the area indicating that it is an REA. Near the main point of entry provide a laminated drawing showing the boundaries of the REA.

Fire and Smoke Dampers

22. The REA shall be protected from fires occurring within adjacent parts of the area beyond the REA. Air conditioning and ventilation duct penetrations through fire rated barriers shall comply with the requirements Chapter 15 of the MFPE.

23. Consideration needs to be given to the ongoing access and maintenance requirements associated with smoke dampers.

24. Refer to the MFPE Chapter 15 - Explosive Ordnance Buildings.

Maximum Surface Temperature of Electrical Installation and Equipment

25. All REA installations shall use wiring and equipment that does not exceed the normal service temperature limits shown in Table 4.1 of the Wiring Rules under normal service conditions. The exceptions permitted under Clause 4.2.3 of the Wiring Rules are not permitted in REAs.

26. Wiring shall be protected against overload and short circuits in accordance with the Wiring Rules and AS/NZS 3008.1.1. These standards permit a short term conductor temperature excursion during the time the protection is interrupting a short circuit. Bunching of conductors may give rise to high temperatures which may exceed the touch temperature and/or damage the insulation and shall be avoided.

27. Equipment shall be protected against overload and short circuits without damage that renders it unsuitable for further use. This requires the addition of overload protection for the equipment in addition to the short circuit protection offered for the wiring. The setting of the overload device shall be in accordance with the manufacturer's recommendation.

Restricted Electrical Area Dossier and Operation, Maintenance, Repair and Overhaul

28. Information shall be provided for the purposes of operation, maintenance, repair and overhaul. The collection of information shall form a Restricted Electrical Area Dossier. This dossier can be in electronic or hard copy form and must be readily accessible from the premises. The results of all tests must be included in the dossier, including tests as per the Wiring Rules detailed below. Electronic versions of the Restricted Electrical Area Dossier shall be stored electronically within the Defence Records Management System (DRMS) / Objective in a location where it is accessible to the persons in control of the area. It shall be in a form where the required information can be made available to those who need it for the safe operation, maintenance and alteration of the installation. It shall be modified and supplemented as necessary to keep records up to date. The information which shall be included in the dossier is detailed in Appendix 1 to this annex.

REQUIREMENTS WITH REFERENCE TO THE AS/NZS 3000:2007 (KNOWN AS THE AUSTRALIAN AND NEW ZEALAND WIRING RULES)

Introduction

29. All REA installations shall comply with the safety principles described in paragraphs 8 – 12 of this annex and the additional requirements prescribed below which are arranged in the same Section headings as the AS/NZS 3000:2007 edition of the Australian and New Zealand Wiring Rules.

Requirements in addition to those contained in the AS/NZS 3000:2007 Wiring Rules Section Two – General Arrangements Control and Protection

30. There are special requirements relating to the arrangement of switchgear and control gear in addition to those contained in the Wiring Rules. These are contained in the Section titled: *General Arrangements Control and Protection* in Regulation 6.3 Procedure 1, paragraphs 1.93 to 1.114.

31. Portable equipment used inside an REA shall comply with the same protection requirements and operating temperature limits required for the fixed installation. Battery operated portable test equipment shall only be permitted if incapable of exceeding the specified touch temperature limits during normal and abnormal operation.

Requirements in addition to those contained in the AS/NZS 3000:2007 Wiring Rules Section Three – Selection and Installation of Wiring Systems

32. All wiring systems inside the REA shall be selected and installed to minimise the risk of mechanical damage which may result in a fire.

33. All wiring shall be suitably located and protected to avoid physical damage.

34. Wiring in an REA shall not be located behind inaccessible wall linings or ceiling linings, inaccessible voids, inaccessible cavities and similar areas. Wiring shall not be embedded directly in concrete, brick or mortar without the protection of a wiring enclosure.

35. All wiring shall be at least double insulated. All wiring shall be supported by conduit, metal cable trays, metal cable ladders, or metal cable ducts. Metal cable supports shall be earthed in accordance with the requirements of the *Wiring Rules* as if the metal was in contact with single insulated low voltage cable.

36. Low voltage wiring inside REA shall be:

a. steel wire armoured (SWA) with armouring earthed at the source end only

b. double insulated cable which is fully enclosed in steel conduit

c. double insulated cable which is fully enclosed in heavy duty flexible steel conduit with insulating outer sheath for final flexible connections

or

d. double insulated cable which is fully enclosed in 2.0 mm minimum thickness metal with a minimum degree of protection of IP 20 in accordance with *AS 60529* - *Degrees of protection provided by enclosures (IP Code)*.

37. Extra low voltage wiring inside or within the defined boundary of an REA shall comply with the other regulations and standards relevant to its application (e.g. telecommunications, fire protection, security); and:

a. be double insulated cable which is fully enclosed by 2.0 mm minimum thickness metal with a minimum degree of protection of IP 20 in accordance with *AS 60529* - *Degrees of protection provided by enclosures (IP Code*)

b. be double insulated fully enclosed in steel conduit

c. be double insulated fully enclosed in heavy duty flexible steel conduit with insulating outer sheath for final flexible connections

or

d. be double insulated fully enclosed in rigid PVC conduit where there is no risk of mechanical damage.

Note:

Flexible PVC conduit and corrugated PVC conduit are not permitted.

38. All wiring shall be selected such that in use, external surface temperature of the outer insulation shall not exceed 90 ^{o}C.

39. Minimum neutral size of a low voltage circuit shall be equal to the size of the associated active conductor.

40. Wiring inside the REA shall not have joints except where required to connect equipment with pre-wired tails. Wiring incorporating the loop-in, loop-out principle is acceptable providing that all parts of the circuit and all equipment and accessories connected to the circuit have adequate rating for the over current protection provided. Junction boxes, except for the purpose of final flexible connections to direct wired equipment, are prohibited.

41. Cable entries to equipment and enclosures shall be side or bottom entry. All cable entries to equipment shall be via cable glands or fittings that maintain the required minimum degree of protection for the housing.

42. Circuits shall be clearly labelled at both ends of every cable to identify the switchboard and circuit of origin.

43. The following wiring methods are prohibited inside an REA:

a. Aerial wiring regardless of insulation, unless part of a crane system in which case flexible double insulated crane cables are acceptable.

b. Earth Sheath Return system (ESR).

c. Voltage track systems and catenary wire systems.

d. Under carpet wiring systems.

44. All external cables shall be fully enclosed with no exposed insulation or sheath.

Requirements for electrical equipment in addition to those contained in the AS/NZS 3000:2007 Wiring Rules Section Four – Selection and Installation of Appliances and Accessories

45. The electrical equipment and wiring shall be designed, selected, installed and maintained to ensure that the electricity will not produce sufficient temperature that could cause the materials of the electrical equipment or wiring to burn.

46. All equipment where arcs and sparks might be generated in service must be totally enclosed in arc-resisting material to contain the arcs and sparks.

47. All equipment shall be selected, installed and maintained to minimise the risk of mechanical damage which may result in a fire.

48. The maximum surface temperature of the external parts of the equipment shall not exceed the temperatures shown in Table 4.1 of the Wiring Rules regardless of location within the REA. All equipment shall be resistant to heat, fire and tracking in accordance with Annex B of AS/NZS 3100:2009 *Approval and test specification - General requirements for electrical equipment*.

49. Equipment shall be selected with a degree of protection appropriate to the environment in which it is located. Minimum degree of protection shall be IP20 in accordance with AS 60529:2004 - *Degrees of protection provided by enclosures (IP Code)*. The degree of protection shall also take into account routine operational activities such as cleaning and some abnormal infrequent occurrences where appropriate.

50. Hazardous area certified electrical equipment shall not be used within an REA except:

a. when there is a hazardous area within an REA

b. the area has already been built to previous regulations using certified equipment

or

c. where alterations are necessary to existing services in locations currently classified as Zone NHE (Non-Hazardous Environment), there are two permitted options:

(1) alterations shall comply with the previous requirements for Zone NHE

or

(2) the entire service (e.g. the entire intruder detection system) shall comply with the requirements of REA.

Note:

> The use of hazardous area certified electrical equipment creates unwanted installation and maintenance costs and requires specific competencies which are different to those of REA installations.

51. Luminaires shall be industrial type, impact resistant, fully enclosed to a minimum degree of protection of IP44. Luminaires shall comply and have been tested in accordance with AS/NZS 60598.1 *Luminaires Part 1: General requirements and tests.* Diffusers shall be held in position by captive fasteners and hinged or secured by lanyard to prevent the diffuser from falling when removed for maintenance. Luminaires shall be individually protected against short circuit and overload (using internally mounted overload protection devices if necessary).

52. All lighting shall be permanently fixed and hard wired. Light fittings shall be surface mounted. Light switches preferably shall be located immediately outside the REA room but in any case rated to the full rating of the circuit protection device.

53. Switch socket outlets (where essential) shall be impact resistant, captive plug, industrial type with minimum degree of protection of IP56. Outlets shall be mounted to avoid mechanical damage and in any case be located at a minimum height of 1000 mm above finished floor levels and 500 mm above benches. Outlets shall be rated to the full rating of the circuit protection device.

54. The following equipment is prohibited in an REA:

a. Switchboards and motor starters.

b. Control and indicator panels for security and fire systems.

c. Control panels other than essential pushbutton stations or displays.

d. Recessed lighting.

e. Bayonet cap lamp holders.

f. Festoon lighting.

g. Electrical equipment with high surface temperatures or causing a focusing or concentration of radiant heat in excess of the maximum permissible surface temperature specified in this document.

h. Cooking, hot water and steam appliances.

i. Batteries (including batteries internal to equipment) except in approved battery operated test equipment e.g. safety ohmmeters.

j. Electric heaters.

k. Capacitors, unless an integral part of other electrical equipment.

l. Electrical equipment containing liquid dielectrics.

Air conditioning and ventilation systems

55. The equipment and installation used for the purposes of heating, ventilating and air conditioning (HVAC) in an REA shall comply with the general equipment and wiring requirements of this Annex. In addition, the HVAC installation shall comply with the requirements of the *Defence Estate Quality Management System - Mechanical Engineering - Requirements for Heating, Ventilation and Air Conditioning, Part 1 - General Guidance* and shall be arranged to prevent risk of ignition of any combustible material from heat transfer from smoke or fire into the REA.

56. Heating appliances in EO areas shall be permanently installed. All electrically operated equipment associated with the heating appliance shall be located outside the REA or in a Plant Room unless it complies with the requirements herein for appliances and accessories in the REA. Portable heaters are not permitted.

57. Electrically heated floors, walls and ceilings are not permitted.

58. Temperature and humidity control is typically provided for process requirements and operator comfort. All electrically operated equipment associated with air conditioning and ventilation systems shall be located outside the REA or in a separate Plant Room unless it is a self-contained unit within the REA and complies with the requirements herein for the appliances and accessories in REA. The preferred arrangement is to locate all equipment outside the REA. Temperature and relative humidity controls and sensors are permitted inside the REA subject to the requirements herein for appliances and accessories in the REA.

59. Exhaust air fan motors shall preferably be located outside the exhaust airstream. The impeller located in the exhaust airstream shall be non-sparking construction.

60. Air conditioning and ventilation duct penetrations through fire rated barriers shall comply with the requirements Chapter 15 of the MFPE.

61. Recirculation air conditioning systems within the REA shall not use electric element heaters. All other heater types shall limit heater surface temperature to comply with the temperature limits of the REA.

62. Humidity control shall be provided by a humidifier (and dehumidifier if necessary) located at the air conditioning unit outside the REA.

63. Within the REA:

a. Fan impellers shall be of non-sparking construction.

b. All ductwork shall be sheet metal and appropriately bonded and earthed.

c. Documented procedures for the inspection and maintenance of the air conditioning and ventilation systems shall be established.

d. Fan motors shall comply with the requirements specified herein for appliances and accessories in the REA.

64. Rotating equipment shall be protected from ingress of or contact with foreign bodies.

Requirements in addition to those contained in the AS/NZS 3000:2007 Wiring Rules Section Five – Earthing Arrangements and Earthing Conductors

65. All protective earth conductors (as defined by the Wiring Rules) inside an REA shall be fully insulated. Buried earth conductors, anti-static conductors and lightning protection systems are not considered protective earth conductors.

66. Where a protective earth conductor (as defined by the Wiring Rules) is required, reliance shall not be made on exposed conductive metalwork as the protective earth conductor. An unenclosed common protective earthing conductor for one or multiple circuits is prohibited inside an REA. Conductors associated with lightning protection and static electricity protection systems are not considered as protective earth conductors in the context of these requirements.

67. Where protection against static discharge is required, an equipotential bonding bar shall be established adjacent the switchboard which supplies the REA. It shall be connected directly to the main protective earth bar of the switchboard. This bar shall be used for equipotential bonding of the static protection systems where these systems are present. Where there is a communications earth system (CES), this system shall be directly bonded to the main protective earth bar in the switchboard.

68. The lightning protection earth termination system shall achieve an equipotential bond to the electrical protective earth by a direct in-ground connection between the lightning protection earth electrodes system and the electrical supply system protective earth electrode(s). The lightning protection earth termination system shall not be directly connected to the equipotential bonding bar.

ANNEX D

Requirements in addition to those contained in the AS/NZS 3000:2007 Wiring Rules Section Six - Damp Situations

69. Equipment shall be selected with a degree of protection appropriate to the environment in which it is located. The degree of protection shall also take into account routine operational activities such as cleaning and some abnormal infrequent occurrences where appropriate.

Requirements in addition to those contained in the AS/NZS 3000:2007 Wiring Rules Section Seven - Special Electrical Installations

70. Non-explosives hazardous areas - Where non-explosives hazardous areas (i.e. those hazardous areas described in the Wiring Rules) co-exist with the REA, refer to the requirements of the Wiring Rules and the MIEE for the management of (non-explosives) hazardous areas.

71. Isolated Supply - The electricity supply to EO areas may be direct or alternating current; the voltage to earth must not exceed 250V RMS and apart from the following exceptions, one point of the system must be earth referenced at the source. Electrical separation (Isolated supply) and extra low voltage electrical supplies may be used:

a. Subject to the requirements of Section 7 of Wiring Rules.

b. Main switches, switches and isolators shall operate in all live conductors.

c. The sources of supply shall be external to the REA.

d. The installation shall be arranged to protect the supply from transient or steady state over voltage.

72. Telecommunications equipment - Telecommunications equipment and wiring preferably should be located outside of REA. Where this is not possible, the requirements and principles of the other sections of this document shall be met with the following exceptions. Fibre optic cabling (without any conductive core) shall be clearly identified externally but need only be installed in accordance with the relevant telecommunications cabling standards and regulations. Secure extra low voltage communications cabling may be installed in clear conduit where required but shall not be located where prone to high impact or within 3m of explosive ordnance. It is recognised for the purposes of this standard (and by regulatory authorities) that fire protection and security installation wiring may also be considered as telecommunications cabling. Any telecommunications equipment and installation must also comply with the relevant requirements and regulations of the Defence communications infrastructure standards and the Australian Communication and Media Authority (ACMA).

73. Security installations - Security installations shall be subject to the same principles and requirements herein for general electrical installations. The following clarifications are provided:

a. Temperature limits of all security systems wiring and equipment shall be to touch temperature limits as described in this document. Measures shall be taken to limit maximum power to devices by limiting maximum possible voltages and currents under normal or abnormal conditions.

b. Batteries and power supplies inside an REA are prohibited.

c. End of line devices shall be rated and enclosed to prevent exposed excessive temperatures in the REA under normal and abnormal operating conditions.

d. Degree of protection for equipment and accessories shall suit the environment and achieve a minimum degree of protection of IP 20 in accordance with AS 60529:2004 - *Degrees of protection provided by enclosures (IP Code).*

e. Equipment shall be located and/or protected in a manner to avoid mechanical damage.

f. Security systems panels shall not be located within the REA.

74. Fire Protection - Refer to the MFPE for guidance. Where fire protection wiring and equipment must be installed inside an REA, it shall comply with the general equipment and wiring requirements of this standard.

ANNEX D

Requirements in addition to those contained in the AS/NZS 3000:2007 Wiring Rules Section Eight – Verification (Inspection, testing and maintenance of electrical installations including commissioning)

75. Electrical installations shall be inspected, tested and commissioned in accordance with AS/NZS 3000 and as described herein.

76. The results of these inspections and tests shall be recorded and retained in the REA dossier.

77. All work undertaken during planned inspection; testing and maintenance shall be carried out in accordance with the EO area work instructions, procedures and permit requirements.

78. Testing of equipment must be carried out when the area is emptied of explosives unless the test equipment is suitable for use within the REA.

79. The frequency of inspections of REA electrical equipment is to be in accordance with Annex G. Once the inspection frequency has been established, the installations shall be subjected to interim sample inspections to support or modify the established inspection intervals.

80. Carry out and provide evidence of compliance with the recommendations and requirements of the Wiring Rules Section 8 – *Verification* is to be provided and recorded. Include all details in the Restricted Electrical Area Dossier which is specific to the installation.

81. Carry out and provide evidence of compliance with touch temperature limits of Table 4.1 of the Wiring Rules is to be provided and recorded using a currently calibrated remote temperature measurement device with the equipment in operation. The maximum surface temperatures shall be verified after installation by use of a calibrated hand held remote temperature measuring device. The sum of the maximum temperature reading plus the accuracy tolerance of the instrument shall not exceed the values provided in Table 4.1 under normal operating conditions. The resolution of the instrument shall be adequate to measure the actual temperature of the hottest part of the external surface of the equipment, wiring and accessory. Record the ambient room temperature at the time of test.

82. Test and provide evidence of compliance of the earthing, lightning protection and static earthing systems including results of continuity and resistance measurements are to be provided and recorded.

83. Provide a record of all measurements taken, degree of uncertainty, test method and instrumentation used. Record the serial numbers and calibration dates of all of the instruments used.

84. Photographic evidence is to be provided of:

a. Location and depth of burial of all underground electrical services including earth ring conductors.

b. Any important elements “built-in” and inaccessible for later inspection.

c. Separation of static earthing systems and electrical services from lightning protection down conductors.

d. Equipotential bonding of the structure to the lightning protection system.

e. Sealing of all fire rated penetrations.

85. The locations to which the photographs relate shall be shown on the as-built drawings.

86. Tests and inspections shall include but not be limited to the safe and satisfactory operation of RCD protection, emergency evacuation lighting, artificial lighting, lightning protection, electrical protection system earthing, static earthing, switchboards, integrity of penetration sealing, integrity of enclosures, integrity of insulation, integrity of fixings and supports, tightness of connections and verification of electrical installation touch temperature limits. Due to the nature of the tests and test equipment, it may be necessary to advise that some tests of the electrical installation in REAs be carried out when the area is emptied of explosives.

87. The integrity of degrees of enclosure of all electrical equipment and enclosures is to be verified at completion. Verify adequate ventilation/shading or other treatment as required to maintain ambient temperatures inside enclosures to within the rated operating limits of the enclosed equipment. Include details in the Restricted Electrical Area Dossier.

88. Installations shall pass periodic inspections prescribed in this instruction to verify the installations continue to be safe.

89. A record of the various metals that have been bonded to the lightning protection system is to be provided and included in the dossier. Verify the compatibility of dissimilar metals and treatments used.

90. Current fire test certificates for all smoke damper installations used to protect the REA are to be provided.

Appendix

1. Restricted Electrical Area - Dossier

APPENDIX 1 TO ANNEX D

RESTRICTED ELECTRICAL AREA – DOSSIER

1. The following information shall be provided for verification of compliance, operation, maintenance, repair and overhaul of all installations. The information shall be kept and maintained in a Restricted Electrical Area Dossier.

2. This dossier can be in electronic or hard copy form and must be readily accessible from the premises. Electronic versions of the Dossier shall be stored electronically within the Defence Records Management System (DRMS) / Objective in a location where it is accessible to persons who are authorised and require access to the information.

3. The dossier shall be maintained to keep records up to date.

4. Each dossier shall include relevant information for all services such as electrical, mechanical, fire, security, communications, lightning protection, static protection, earthing and bonding.

5. Details to be contained within the dossier shall include:

a. Record of designers, installers, testers, inspectors, maintainers, overhaulers and their competencies.

b. Record of REA classification including the boundaries.

c. Photographic record of concealed features required by Annex D.

d. As-built drawings.

e. Test and inspection results including certification.

f. Design certification.

g. Installation certification.

h. Verification of enclosure integrity, fire separation, penetration stopping integrity.

i. Compliance by specific design/dispensations.

j. Maintenance plan.

k. Manufacturers operating and maintenance instructions.

l. Occurrences of maintenance repair and overhaul.

6. The maintenance plan shall include details of the recommended inspection and maintenance intervals required to maintain:

a. Safe operation.

b. Consistency with design assumptions.

c. Consistency with each manufacturer's recommendations.

7. Include the recommended cleaning and relamping interval for the lighting installation and the planned safe access method for relamping and repair. Include statutory requirements for inspection and maintenance in the maintenance plan.

8. Include a record of the initial and any subsequent touch temperature measurements for the hottest part of the external surface of each item of electrical equipment, wiring and accessory under normal operating conditions. Record the ambient room temperature at the time of test.

9. Operating instructions shall clearly indicate and refer to the equipment actually installed. Exclude pages with irrelevant material and highlight relevant information on data sheets and equipment manuals.

10. Suitable formatted inspection and test sheets shall be provided for the first 24 months of operation.

11. As-installed records shall be entirely self-contained (including legends) and shall clearly state and show what was actually built. Remove performance requirements, instructions and notes intended for the installer from the drawings. Legends shall be complete with relevant information but shall include only relevant information. Drawing standards and records shall comply with the requirements contained in the Manual of Infrastructure Engineering - Electrical (MIEE). As-built drawings are to be supplied to Defence in accordance with the spatial data management plan (SDMP) where applicable.

ANNEX E

ELECTRICAL NON-CONFORMANCE DISPENSATION

File No:

Director of Ordnance Safety

REQUEST FOR DISPENSATION FROM PRESCRIBED REQUIREMENTS

Reference:

A. Letter

B. Supporting documentation/Reports

Introduction

1. (Competent person's name) has been engaged as the competent person for the (project name) project, located at (site/base location, STATE).

2. This document has been provided for the (project name), in order to make a request to the Director of Ordnance Safety (DOS) to approve the engineering solution(s) which depart from the prescriptive electrical safety requirements of the eDEOP 101.

3. This document and its attachments are submitted under the provisions of eDEOP 101 Regulation 6.3 Procedure 1 Annex C and Annex D.

Background

4. The background for this request is outlined in reference A.

Area Description

Area Name:	
Area Number:	
DEMS Number:	
Area Use:	
Room No:	
Type of Construction:	
Other Description:	

ANNEX E

Issue Summary

5. The following table identifies the issue(s) with respect to achieving compliance with the prescriptive requirements eDEOP 101 Regulation 6.3 Procedure 1 Annex C and/or Annex D and the proposed engineering solution(s).

No	Description of issue and engineering solution	eDEOP Ref
1.		
2.		
3.		

Supporting Documentation

6. The following documentation is provided to address the dispensation request for engineering solutions as listed in the previous table. The documentation is attached as reference B.

No.	Document
1.	
2.	
3.	

Competent Designer's Statement:

I propose the engineering solution(s) referenced by this dispensation request. Defence approval of this request will allow me as the competent electrical designer to complete the design certification for compliance of the electrical installation design with the requirements of the eDEOP 101 Regulation 6.3 Procedure 1 Annex C/Annex D. I confirm that the engineering solutions proposed are consistent with the obligations under the Commonwealth WHS Act and Regulations. I confirm that I have recorded and communicated any conditions necessary to ensure that the installation is without risks (to the extent required by the Act) when used for a purpose for which it was designed or when carrying out any activity related to the installation such as construction, maintenance and demolition.

Name:

Signature:

Date:

Accreditation:

Project Officer's Statement:

I support the submission and consideration of this electrical non-conformance dispensation application.

Name:

Position:

Signature:

Date:

ANNEX E

Defence Review/Risk Assessment Team Comments:

The dispensation application and referenced documents have been reviewed. Approval is **Recommended/Not Recommended** subject to the following comments:

a. (User representative)

b. (Site OHS representative)

c. (Competent reviewer)

Name:……………………………….. Signature:…………………………………

Position:……………………………… Date:……………………………………….

Directorate:……………………………

Department of Defence

Approval

The application for dispensation from the provisions of **eDEOP 101 Regulation 6.3 Procedure 1** as detailed above is **approved/not approved** subject to the conditions and comments noted with this application.

Name:……………………………….Signature:……………………………

Position:……………………………..Date:………………………………….

Directorate Ordnance Safety
Department of Defence

Enclosures:

1. Reference A
2. Reference B

ANNEX F

EXPLOSIVES CIRCUIT TEST EQUIPMENT AND PORTABLE FIRING TEST EQUIPMENT

The approved ECTE referred to in this regulation are:

AIRCRAFT FIRING CIRCUIT TEST SET AN/AWM 54

DAMDIC Resistance Meter

DETECTOR, Voltage MK 4

DETECTOR, Voltage MK 6

ELECTRONICS 101-5RZ-0

ELECTRIC BOMB FUZING CIRCUIT TEST

IGNITER CIRCUIT TESTER ALINCO 101-5BFG

IGNITER CIRCUIT TESTER ALINCO 101-5CFG

IGNITER CIRCUIT TESTER ALINCO 101-5AI

IGNITER CIRCUIT TESTER ALLEGANY 101-5AI

IGNITER CIRCUIT TESTER SPACE

IGNITER CIRCUIT TESTER SPACE 1015HJNAV

NO VOLT METER, SIMPSON ELECTRIC 260-XLP

NO VOLT METER, SIMPSON ELECTRIC 260-6

NO VOLT METER, SIMPSON ELECTRIC 260-6XLPM

NO VOLT METER, SIMPSON ELECTRIC 260-8

NO VOLT METER, SIMPSON ELECTRIC 270

OHMMETER, Circuit testing N3

OHMMETER, Safety, AMPTEC 620UK

OHMMETER, Safety, AMPTEC 640N

OHMMETER, Safety, AMPTEC 630BN

OHMMETER, Safety, COULTON 278BS3E

OHMMETER, Safety, CULTON SERVICE 278

OHMMETER, Safety MK 6

OHMMETER, Safety MK 5

OHMMETER, Safety, MK 7

OHMMETER, Safety N1 MK 1

ANNEX F

OHMMETER, Safety N2 MK 1

OHMMETER, Safety N4 MK 1

OHMMETER, Safety, RN 5306

OHMMETER, Simpson, 260

REMOTE ELECTRICAL ARMING DEVICE 522-174-0075

SET – A/E24T-127

STRAY VOLTAGE TEST SET AN/ALM 176

TEST SET, Safety CT 582/3

The approved PFTE referred to in this regulation are:

DAMDIC BLASTING MACHINE

EXPLODER, DC, Electric, Hand-held, L3A2, SHRIKE

EXPLODER, DC, Electric, Hand-held, L3A3, SHRIKE

FUSE, TIME DELAY PED100D and PED100P PROGRAMMER

ANNEX G

INSPECTIONS AND TEST PERIODS

Item	Zones 0E, 1E, 2E & Zone 20E, 21E	Zones 22E and 33E	REA
Referenced Regulations and Standards	Reg 6.3 Proc 1 Annex C, AS/NZS 60079.14 and AS/NZS 60079.17		Reg 6.3 Proc 1 Annex D
	Frequency		
Electrical Equipment and Installation	As per statutory requirements and manufacturer's recommendations included in the installation dossier		
Static Earth, Equipotential Bonding Installations	Not exceeding 24 months and more frequently where circumstances warrant		
Earth Continuity and Electrode Resistance	As per AS/NZS 1768 requirements		
Intrinsically Safe Earth Systems	Not exceeding 24 months and more frequently where circumstances warrant		Not Required
Insulation Resistance of Electrical Installation	Not exceeding 24 months and more frequently where circumstances warrant		
Flexible Cable Installation - fixed	Flexible Cable Not Permitted	Not exceeding 24 months and more frequently where circumstances warrant	
Flexible Cable Installation - moving	Flexible Cable Not Permitted	1 month	
Residual Current Devices (RCDs)	AS/NZS 3760		
Lightning Protection Installation	As per AS/NZS 1768 requirements		
Static Control Flooring (Conductive)	12 months		
Static Control Flooring (Antistatic)	6 months (test to include times when humidity is low)		
Wrist Straps	Check fitted wrist strap with personnel test meter prior to work in static control area		
Leg Straps	Check fitted leg strap with personnel test meter prior to entering static control area.		
Benches and Chairs	12 months		Not Required
Conveyors	12 months		Not Required
Personnel Test Meters	Calibration every 12 months or as recommended by manufacturer		Not Required
Antistatic and Conductive footwear	Check with personnel test meter prior to entering static control area		

1. The maximum test periods are shown above. Shorter test periods may be required where circumstances warrant.

PROCEDURE 2 - PROTECTION OF EXPLOSIVE ORDNANCE AGAINST ELECTROSTATIC DISCHARGE HAZARDS

Introduction

2.1 Many explosive substances and articles (collectively referred in this instruction as ExplosiveOordnance (EO)) are sensitive to Electrostatic Discharge (ESD). Where the item cannot be hardened or protected it is necessary to prevent sources of hazardous ESD endangering explosives. Hence, in all facilities where explosive substances are exposed and EO fitted with Electro-Explosive Devices (EED) or EED alone are handled, precautions must be observed to prevent hazards due to static electricity build-up and discharge. This is achieved by ensuring electrical charge is removed at least as fast as it is generated.

Purpose

2.2 This instruction prescribes the requirements to minimise ESD hazards during storage, handling, testing and assembly of certain types of electrically sensitive EO or components.

General

2.3 The susceptibility of the most sensitive component to ESD dictates whether special precautions are required and if they are to what level. The phrase ‘sensitive component’ is intended to encompass any safety critical component of a weapon system or platform that could be compromised by ESD. Direct initiation of explosives is the main concern but indirect mechanisms must be considered when any safety critical sensitive electronics, fuels or degradation products, eg hydrogen, are present.

2.4 Safety will be assured by compliance with the requirements of an appropriate ESD protected area. These requirements are determined by the need to keep any electrostatic energy sources below the ignition energy of the most sensitive exposed component, in accordance with the following:

a. A Conductive Regime is required in the presence of explosive substances with a spark sensitiveness[1] of less than 1 milli-joule (mJ) or EED that may be initiated below an ignition energy of 1 mJ. This regime must be enforced when processing EO containing any component whose sensitivity is not known – see Annex A.

b. An Anti-static Regime[2] is required in the presence of EO that in its present configuration has an ignition energy of above 1 mJ and below 156 mJ[3].

2.5 Whenever susceptible EO is handled it is essential that this safety policy is applied. The supervisor of the building or process must ensure that all exposed sensitive components are identified and appropriate electrostatic control measures implemented and maintained. Personnel are to be aware of any exposed sensitive components and know what is required to avoid an ESD hazard. This

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1 The electrical spark ignition sensitivities of explosive substances are determined using the techniques such as in the EMTAP Manual of Tests, Test No. 6/66 and 7/66. Sensitivities of bridgewire EED characterised by the UK Defence Ordnance Safety Group are tabulated in Ordnance Board (OB) Pillar Proceeding P101 Annex C (most low voltage bridgewire EED can be ignited by energies of a few mJ and, therefore will require a Conductive Regime if they are handled or have a connection that is exposed).

2 Apparent vs True Susceptibility - in most cases components of all-up weapon systems are protected from harmful ESD by other components, eg casing. In some cases this includes deliberate measures such as covers, packaging and circuit breaks provided by safety and arming units etc. Consequently, it will normally be reasonable to assess the weapon in its present state rather than its most vulnerable configuration. A Conductive Regime must be enforced when there is any doubt over the susceptibility of the weapon.

3 NATO STANAG 4235 defines the worst case human electrostatic source as charging a low-loss, low-induction 500 Pico farad (pF) capacitor to 25 kilovolts (kV) and discharging it through a 500 ohm (Ω) resistor with not more than 5 micro henries (µH) of total circuit inductance. This defines the charge from such a body as 156 mJ ($E= \frac{1}{2} CV^2$). Therefore explosive substances and/or articles with ignition energies of above 156 mJ only require electrostatic control measures in the presence of unusual charge generation mechanisms.

requires training in the use of personal equipment such as clothing, footwear, Hazardous Area Personnel Test Meters and hand tools. Whenever possible safe operation is to be achieved by design rather than procedure.

2.6 Only when EO is not susceptible to ESD in all aspects of its use, can electrostatic hazards be disregarded.

2.7 **Sources of Static Electricity.** Electrostatic charges can develop to hazardous levels in numerous ways, some of which are described below:

a. Electrostatic charges are produced wherever separation of surfaces occurs - the higher the electrical resistance of the materials involved, the larger the charges produced.

b. Persons may acquire electrostatic charges when moving by the rubbing of their clothing either between garments or against surfaces.

c. Personnel may acquire electrostatic charges by contact with other charged bodies or persons, or by induction without contact.

d. Moving parts of machinery or vehicles that are not properly earthed (eg the wheels of trucks or driving belts of machinery; aircraft rotors and airframes), may develop electrostatic charges via friction or induction.

e. The processes of pouring, sieving, mixing and grinding of poorly conductive materials, including explosives, eg gunpowder and propellants, and flammable liquids produce electrostatic charges.

f. The use of brushes, cloths, etc, for cleaning develops electrostatic charges.

2.8 **Anti-static Regime Electrostatic Precautions.** Protection against the harmful effects of ESD in an Anti-Static Regime are provided by:

a. a common system of earthing and equipotential bonding which includes all structural metalwork, the lightning and electrostatic protection systems and all other significant conductive articles within the electrostatic protected area; and

b. the use of anti-static materials for flooring, footwear, clothing and drive and conveyor belts.

The impedance of the common earth should be the lowest required by any of the standards for the systems involved. While this addresses larger conductors, the goal is to ensure that no items are capable of retaining significant charge; this is most easily achieved by excluding electrical insulators.

2.9 It is important also that EO assemblies are not connected to the facility earth system in such a way that lightning strike current can flow through the assembly, eg by connecting directly to a perimeter earth tape or a lightning down conductor. Sensitive items in explosive assemblies will be adequately protected from accumulation of hazardous electrostatic charge by a connection to earth of less than 1×10^6 ohm[4].

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[4] To avoid a potential hazardous accumulation of charge the path for charge dissipation, ie ground, must permit a current that at least balances the charging current. Potentials below 100 volts equate to 2.5 microJ on a 500 picoFarad person. Therefore, assuming the path for charge dissipation from the human body obeys Ohm's Law, safety can be assured if the resistance of path to ground is less than 100V/I (Dissipating Current) ohms. In the worst case it is assumed that a charge generating process associated with a person can yield a charging current of 10^{-4} amps. Consequently, the minimum dissipation current to ensure safety will be obtained when the resistance to ground is 1×10^6 ohms. In practice this can be achieved by the use of flooring and footwear or wrist straps with appropriate electrical properties.

2.10 Conductive Regime Electrostatic Precautions. Maximum precautions against static electricity are required when EO or explosive compositions are segregated for investigation because of suspected increased sensitivity, ie less than 1 mJ, or damage. They are also required when explosive substances and explosive articles listed in Annex A are exposed or handled. Maximum precautions require the use of conductive, as opposed to antistatic, materials for flooring, footwear, bench tops, etc, control of the relative humidity and provision of means of ensuring that all personnel, vehicles and equipment will dissipate any accumulated static charges before entering the workrooms.

2.11 Related Documents and Standards. A list of related documents and standards for guidance is given in Annex B.

ELECTROSTATIC PRECAUTIONS

Control of Sources of Static Electricity[5]

2.12 The mobility, high capacitance and conductivity of personnel, make them capable of generating hazardous levels of electrical charge and releasing this in a single incentive discharge. Therefore, all those involved in handling susceptible EO or processing explosives must be effectively and continuously grounded.

2.13 Effective continuous grounding can readily be achieved by providing a discharge path to ground via conductive/anti-static shoes, leg straps[6], floors and wrist straps connected to grounded conductors.

2.14 It is important to maintain relative humidity (see limits at paragraphs 2.56 and 2.57, and Annex C) within EO processing rooms in order that static charge cannot easily be acquired and can be quickly dissipated. Some materials require many hours of conditioning at the appropriate relative humidity to achieve the desired electrical behaviour. The safe dissipation of charge from the surface of exterior clothing and packaging made from natural fibre, eg cotton, is especially reliant on them being conditioned at the appropriate relative humidity.

2.15 There is to be a common system of earthing and equipotential bonding which includes all structural metalwork, the lightning and electrostatic protection systems and all other significant conductive articles within the electrostatic protected area. All anti-static and conductive materials including plant and equipment are to be at ground potential.

2.16 All movable equipment (eg a trolley) is to be provided with an effective earthing system. Tyres are to be of anti-static or conductive material. Gaseous or fluidic systems (LP & HP air) are to be fitted with grounded anti-static or conductive components. Drive or conveyor belts are to be conductive/anti-static depending upon the regime in force within the room.

2.17 If operations performed within a building require the installation of an anti-static or conductive floor, it is preferable to install a conductive grade floor to accommodate future flexibility. However, in some environments this might be outweighed by the increased risk of electrocution in the event of an equipment fault.

2.18 A Hazardous Area Personnel Test Meter (HAPTM) is to be used in all buildings where electrostatic precautions are in force. All personnel are to test their resistance to earth as they enter the room. The HAPTM is to be used to measure the total resistance to earth of personnel wearing conductive or anti-static footwear on conductive or anti-static flooring. See paragraphs 2.76 to 2.83 for further details.

2.19 The object of electrostatic precautions is to reduce electrostatic charging to a level less than required to ignite the most sensitive material being handled. Subsequent paragraphs detail

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5 Reference should be made also to AS/NZS 1020 the control of Undesirable Static Electricity, for further guidance.

6 ‘Leg straps’ is to be included in the definition of 'footwear' throughout this chapter.

precautions to be observed in the construction of buildings, use of fixed and portable equipment and actions required for protection of personnel.

Conductive, Anti-static and Non-conductive (Insulating) Flooring

2.20 For the purposes of providing electrostatic precautions, conductive, anti-static and non-conductive flooring is defined as follows:

a. **Conductive Grade[7].** The resistance of conductive floor surface to earth must not be greater than 50×10^3 ohms when measured in accordance with Annex D.

b. **Anti-static Grade[8].** The resistance of anti-static floor surface to earth must be between 50×10^3 ohms and 2×10^6 ohms when measured in accordance with Annex D.

c. **Non-conductive Grade.** The resistance of non-conductive floor surface to earth must be greater than 100×10^6 ohms.

The apparent 'gap' in resistance values between anti-static and non-conductive grades is deliberate. Floors with resistance to earth between 2×10^6 and 100×10^6 ohms are unsuitable for any EO building covered by this instruction.

Provision of New Conductive Flooring

2.21 Conductive flooring is to be provided in accordance with BS 2050:1978 and BS 3187:1996.

2.22 Conductive flooring is to be tested in accordance with Annex D. New installations of conductive flooring are to be tested at intervals specified in paragraph 2.89. When accepting new conductive floors, the initial measurements of floor resistance are to be well below the maximum of 50×10^3 ohms to allow for progressive degradation through life (suggested limit at installation < 30×10^3 ohms).

Provision of New Anti-static Flooring

2.23 Anti-static flooring is to be provided in accordance with BS 2050:1978. Anti-static flooring is designed to dissipate a static charge by relatively slowly discharging the floor and anything electrically connected to it, to earth. Anti-static floors are to have a resistance from the surface of the floor to earth of between 50×10^3 ohms and 2×10^6 ohms.

2.24 Anti-static flooring is to be tested in accordance with Annex D. New installations of Anti-static flooring are to be tested at the intervals specified in paragraph 2.90.

New Construction of Explosive Ordnance Buildings

2.25 Unless otherwise determined by a comprehensive risk assessment, new construction and major repairs to existing EO facilities are to comply with the following minimum requirements for flooring:

a. **Test Equipment Rooms.** (No EO permitted). Anti-static flooring.

b. **Test Cells.** (EO in assembled round or section configuration only). Anti-static flooring.

c. **Weapon Assembly Rooms.** Conductive or anti-static flooring depending on the sensitivities of the EED being handled.

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[7] See AS/NZS 1020:1995, Clause 1.4.4.2.

[8] The resistance limits specified in AS/NZS 1020:1995 are not applicable to anti-static flooring and other surfaces for installation in EO facilities used for the handling and/or maintenance of EO and explosive substances that are sensitive to electrostatic discharge.

d. **Combined Assembly/Test Areas.** Conductive or anti-static flooring depending on the sensitivities of the EED being handled.

e. **EO Workshop Rooms.** Conductive or anti-static flooring as required by the equipment or compositions to be handled.

2.26 The risk assessment required at paragraph 2.25 is to be approved by the Project Director/Manager. A copy of the risk assessment is to be retained by the facility manager and be readily available for future reference.

Use of Existing Explosives Buildings

2.27 The following minimum modifications are to be made to EO buildings already in existence in Defence establishments where anti-static protection systems are required but are not fitted:

Metal plates that are electrically bonded to the building earth are to be provided at the entrance to each compartment in which EED are to be inspected, tested or assembled. These plates are to be sited so that personnel and trolleys conveying stores containing EED must, when entering the compartment, automatically make contact with the plate. Similar earthed plates are to be provided at each working position in the compartment where work is to be carried out on EED. Metal earthing bars, hand rails or plates electrically bonded, at one point only, to the building earth at floor level, are to be provided along one wall of each compartment.

2.28 When work is being performed on electrically sensitive EO in modified buildings, the EO must be connected to the building earth, together with any associated support equipment or vehicles. Provision must also be made to ensure that any electrostatic charges developing on personnel are kept below the level liable to present a hazard to the equipment. This may be achieved by means of conductive or anti-static footwear (depending on the sensitivity of the equipment) or wrist-straps in conjunction with earthing plates or bars. Anti-static clothing is also required.

2.29 The electrostatic precautions detailed in paragraph 2.27 are not authorised for new EO buildings. The optimum requirements are to be applied to new works.

Building Signs

2.30 When conductive or anti-static flooring is installed, a sign prohibiting unauthorised electrical equipment is to be displayed.

2.31 When work is in progress that requires conductive or anti-static regimes, a sign indicating the dangers of entering without the correct clothing is to be prominently displayed at points of entry to, or within buildings or rooms.

2.32 The signs required at paragraphs 2.30 and 2.31 are to comply with the requirements of a 'regulatory sign with text' in AS 1319, ie Table 2.2 and Annex B of AS 1319.

Use of Plastic and Polymer Materials and Packaging

2.33 Loose resistive (surface resistivity of 10^{11} ohms) materials such as plastic and polymer materials, rubber, glass, etc will develop electrostatic charges and the use of such materials in EO areas must be strictly limited. Such materials in working areas are to be restricted, whenever possible, to a size not exceeding 75 cm^2.[9]

2.34 Large items such as tarpaulins made from non-conductive plastic material, eg PVC, Nylon, etc, are not to be taken into any room where electrostatic precautions are required. Plastic packaging materials, eg polystyrene, are not to be kept in any room requiring electrostatic precautions. Any items

[9] Polycarbonate safety visors would exceed this limit and should be excluded from both Anit-static and Conductive Regimes.

received in such packing are to be unpacked immediately on receipt and the packaging removed from the room.

Earthing Installations

2.35 Regulation 6.3 Procedure 1 details the earthing requirements to obtain equipotential bonding. In addition, in all EO buildings, efficient bonding and earthing of all metallic enclosures and equipment, all exposed extraneous conductive parts, major metal work in the structure of the building, metallic service pipes and the armouring of main supply cables are to be installed in the following manner to protect against stray currents or against the accumulation of electrostatic charges:

a. The metallic sheaths and armouring of the main supply cables, all metallic pipes, eg water, steam, air, etc, rails or guides entering the building are to be bonded to the earthing system at the point of entry or exit outside the structure of the building and earthed at 2 points, one 75 m away from the building and another 150 m away.

b. Metal service pipes are not to be used as earth electrodes.

c. Where the continuity of any apparatus is broken by paint, oil, grease film, gaskets or other nonconductive material, suitable bonding connections are to be fitted to maintain the continuity required.

d. A copper carbon brush or equivalent, held by a suitable spring in close contact with the shaft or other integral part, is to be used on all revolving objects that are required to be earthed.

e. Where drive or conveyor belts are fitted they are to be of the conductive/anti-static type depending on the regime in force.

f. Pneumatic equipment must be fitted with anti-static or conductive components.

g. Bonding and static earthing conductors are to be installed as follows:

(1) The main earthing bar is preferably to be of copper 25 mm wide x 3 mm thick. Where connection is made to an item not rigidly fixed, duplex copper braid 19 mm x 3 mm is to be used. Coiled aluminium strip may be used in some cases. When aluminium is used the number of joints is to be kept to a minimum and preferably they should be welded.

(2) Aluminium may be used for earthing connections for buildings and plant where explosive substances such as Lead Azide, Lead Styphnate or Ammonium Nitrate is manufactured or processed. The sizes of aluminium connections are to conform to those specified for copper above.

(3) The main earthing bar is to be located, if possible, on the outside of the building and is to be securely fixed with screws at intervals not exceeding 1 m.

(4) All main earthing bars or connections thereto which are mounted inside the building are to be spaced off surfaces by a minimum of 12 mm.

(5) All joints in the earthing conductors are to have an overlap not less than the width of the conductor concerned and are to be secured by four rivets of the same material as the conductors and soldered. Alternatively, the joints may be welded or brazed. The electrical conductivity of any joint is not to be less than that of the same length of unbroken conductor.

(6) All earthing conductors are to be run by the shortest practicable route to the earthing medium and are to be located to ensure protection against accidental damage or fracture.

(7) Earthing conductors are not to be painted as this would preclude adequate connections being made.

Electrical Bonding of Conductive and Anti-static Floor Coverings

2.36 When anti-static or conductive floor surfaces are laid, the sub-floor must be protected by an effective damp proof membrane. Bonding strips, to the requirements of paragraphs 2.37 to 2.40, are normally to be laid under each separate piece of the floor covering to ensure effective electrical continuity throughout the floor. Bonding strips may be omitted if the flooring/base combination, eg Tarkett Conductiflor fixed to a ground level concrete base with conductive adhesive, will meet the required resistance values without assistance.

2.37 Where required, bonding strips are to be laid on the sub-floor in the form of a grid under the floor covering. The spacing of the grid is not to exceed 600 mm square and is to ensure that at least two earth paths are available to each piece of floor covering and the grid is to be connected to the electrical earth of the building in two positions, preferably at diametrically or diagonally opposite points of the floor. Grids must not cross flexible expansion joints; if necessary flexible bonding cables may be used to couple adjacent grids.

2.38 Where the floor covering is in tile form the bonding tape should be laid under each row of tiles and all the tapes should be connected together by a tape laid at right angles.

2.39 Bonding tapes of stainless steel are preferred but brass and copper may be used. Aluminium is not to be used. They are to be at least 50 mm wide and have a minimum thickness of 0.2 mm. For some other flooring systems (homogenous polymeric, trowelled finishes) the width of the conductive tapes is not important. The tapes should be mechanically robust enough to last the design life of the floor and provide a low enough resistance to not contribute to the limit for the floor electrical resistance. All under-floor joints are to be made electrically continuous by riveting, soldering or conductive adhesive. Connections to the earthing system of the building are to be made by means of screw clamps.

2.40 An electrically conductive adhesive is to be used wherever possible. If a non-conductive adhesive is used, great care is to be taken to prevent the adhesive impairing the conductance between the bonding tapes and the under surface of the floor covering.

2.41 **Upkeep of Conductive Flooring Material.** In order to preserve the conductive properties of the flooring and to maintain its resistance within the prescribed limits, the floor is to be left untreated and the use of floor waxes and polishes is prohibited. Only the agents, methods and frequency of cleaning recommended by the manufacturer of the flooring material are permitted. Should any area of the floor exhibit evidence of contamination by dirt, grease, etc, which could affect its electrical resistivity, then the area is to be cleaned by the recommended method to ensure continued safety.

Electrical Bonding of other Anti-static Materials, Fixed and Portable Plant and Equipment

2.42 There is to be a common system of earthing and equipotential bonding which includes all structural metalwork, the lightning and electrostatic protection systems and all other significant conductive articles within the electrostatic protected area. All anti-static and conductive materials including plant and equipment are to be at ground potential.

2.43 Generally, all fixed metal objects are to be earthed. Lengths of metal of less than 2 m such as metal window frames, metal ventilators and small metal fittings, eg door handles, hinges, locks, bolts, etc. need not be earthed however, earthing of metal door handles provides a convenient means of discharging any electrostatic charge from personnel on entry to an EO facility.

2.44 Large metal objects permanently located near each other are to be bonded together and earthed through a single connection at floor level, to avoid the creation of earth loops.

2.45 Machines and their accessories such as inspection covers are to be bonded together and earthed. The bonding of metal parts and accessories of a machine should, if possible, be carried out by the manufacturer.

2.46 Screwed unions on conduits are not acceptable as earth paths. Earth bridging straps at each union or a separate internal earth must be provided.

2.47 The metal work of all lifting appliances and hoists must be directly bonded to the earthing system with braided metal tape. If rope is used between the hoist and a hook, this rope is to contain a conducting lead.

2.48 All fixed cradles, benches or tables on which EED are to be held are to be made of metal and are to be earthed, at one point only, to the building earth at floor level; alternatively, wooden benches or tables may be used with the working surfaces covered with earthed conductive material giving the same resistance to earth as the floor. If necessary, this may be achieved by laying the covering over an earthed copper mesh that is connected directly to the building earth. With some stores it is necessary to make an electrical connection between the store and the cradle to ensure continuity but in all cases the metallic upper surfaces of trolleys or cradles are to be bonded directly to the earthing systems. Permanent connections are to be bolted together. Connections to the store may be made by means of crocodile clips on bare flexible braid. The total resistance from the store to earth is not to exceed 1×10^6 ohms.

2.49 Portable metal apparatus, movable cradles and trolleys used for holding or conveying stores require special anti-static precautions to be fitted so that they can be earthed when in use. The resistance from the store to earth is not to exceed 1×10^6 ohms.

2.50 Small tools and gauges which are hand-held need not be earthed, but must be placed on an earthed table or tray when not in use.

2.51 Where provided, stools or chairs must be of metal frame construction and provide an adequate area of unpainted metal in contact with the floor to ensure a good electrical contact without damage to the floor covering. Non-conductive plastic or rubber feet must not be used. Paint is to be removed from the area of the metal frame in contact with the floor. The seat material must be capable of dissipating charges and must be adequately bonded to the metal frame.

2.52 **Mobile Equipment, Trolleys and Vehicles.** Mobile equipment, trolleys and vehicles are to be of metal and have conductive wheels. Alternatively, wooden floors or supporting surfaces may be used, covered with conductive material bonded to the wheels or earthing strap. Where fitted, conductive rubber tyres are acceptable; where rubber tyres are not conductive, alternative means for earthing must be provided. All such equipment must be earthed at the waiting position or on entry into any building not provided with conductive/anti-static grade floors. The leakage path of resistance through the equipment to earth is not to exceed 1×10^6 ohms.

2.53 **Explosives Storage Stacks and Racking.** Refer to Regulation 6.2 Procedure 1 for earthing requirements of metal racking.

2.54 **Special to Type Equipment.** Design authorities for special to type support equipment for EO assemblies, must identify any requirement for the dissipation of static charges and must design support equipment with the necessary connection to the ground earthing plane using conductive wheels/tyres, trailing leads, feet etc.

2.55 **Earthing Policy for Weapons.** The policy outlining the earthing of weapons during storage, handling or processing at EO buildings and facilities are outlined at Annex E.

Relative Humidity Conditions

2.56 To ensure effective control of electrostatic hazards during explosives processing and thus avoid explosive accidents, the control of relative humidity (RH) within explosives processing rooms is essential. Supervisors of processing facilities are responsible for considering the effects of RH before any explosives processing. No components of an electrostatic protection strategy will function effectively if the RH is too low; anti-static clothing, shoes, dissipative coatings, etc will be ineffective and personnel will be at risk.

2.57 The following RH limits apply in explosives processing facilities:

a. **Conductive Regime.** Within a conductive regime, a RH of not less than 65% is to be maintained. RH limits may be reduced to an absolute minimum of 40%. However, if site supervisors wish to process between RH of 65% and 40% they must comply with all of the following:

(1) No processing of primary explosives.

(2) Operators must continue to pass a HAPTM test.

(3) Exclude all materials whose static dissipative properties are dependent upon a high RH.

(4) Demonstrate that no hazardous levels of electrostatic charge can exist at reduced RH.

b. **Anti-Static Regime.** Within an anti-static regime, a RH of not less than 40% is to be maintained.

PRECAUTIONS AGAINST ELECTROSTATIC CHARGE ON PERSONNEL

General

2.58 Protection for personnel working in EO buildings where electrostatic precautions must be observed, is afforded by provision of special clothing and footwear and facilities to measure their electrical resistance to earth. Special precautions are also required to protect personnel against electrocution.

Clothing[10]

2.59 Specially designed clothing of satin drill or other suitable material is to be worn by all workers in areas requiring electrostatic precautions. Clothing (coveralls are recommended although a 2 piece outfit is permissible) is to fit properly and be correctly fastened. Any treatment applied to the material such as Proban anti-flash treatment must not degrade the electrostatic properties. Visitors are to wear a dustcoat over their outer clothing.

2.60 Suitable materials for outer garments include the following:

a. Cotton.

b. Polyester 50% and cotton 50% blend.

c. Polyester 65% and viscose 35% blend, however, this material melts with excessive heat.

2.61 Unsuitable materials for outer garments (unless treated with an anti-static process) include the following:

a. Nylon.

b. Pure wool and wool blends.

c. Polyvinyl materials - especially if coated with a nylon base.

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[10] Personnel are to wear outer clothing of materials whose outer exterior surfaces have a surface resistivity of 50,000 x 10^6 ohms or less at the relative humidity in which they are to be used. Therefore the clothing must be stored in an environment of the same or higher relative humidity than its working environment. The clothing must be of a homogenous textile, rather than one that relies upon a conductive grid or coating. Homogenous fabrics compliant with BS EN1149-1:1995 are acceptable.

2.62 The wearing of gloves is prohibited unless authorised by the operating instructions that control the work being undertaken[11].

2.63 The changing of clothing is not permitted in workrooms where electrostatic precautions are observed, except in specified changing areas in clean rooms.

Footwear

2.64 **Resistance Limits.** Conductive and anti-static footwear afford personnel good protection against static build-up. The protection is dependent on the resistance of the shoes being within the limits specified below:

a. **Conductive Footwear[12].** 0 to 150 x 10^3 ohms when measured in accordance with Annex D, paragraphs 12 to 14, and

b. **Anti-static Footwear[13].** 100 x 10^3 to 50 x 10^6 ohms when measured in accordance with Annex D, paragraphs 15 to 17.

2.65 Experience has shown resistance figures may vary from day to day through such factors as climatic conditions, type of socks worn (see paragraphs 2.60 and 2.61) and contamination of the soles of shoes by oil, wax, solvents, etc. Hence, in facilities where HAPTM (see paragraph 2.76) are in use, a pass or failure reading is to be the deciding factor as to the suitability of the footwear being worn from a static risk point of view.

2.66 **Protective Footwear for Visitors.** Visitors entering an EO processing area that requires electrostatic precautions are to be issued with leg-stats or equivalent earthing devices. Once fitted, it is necessary for the person to obtain a pass on the HAPTM. Leg-stats and other charge dissipating devices are to be cleaned as required in accordance with the manufacturers instructions. Depending on the level of electrostatic protection required and the activities to be undertaken by the visitor, it may be necessary to wear leg-stats on both legs, as determined by the Officer-in-Charge (OIC) of the establishment.

2.67 **Manufacturing Standard for Footwear.** Shoes for use in areas where electrostatic precautions are to be observed are to be manufactured to AS/NZS 2210 to the resistance limits specified in paragraph 2.64.

2.68 **Policy for Static Precautions.** It is now to be general policy to observe anti-static precautions for all uses in EO processing facilities where electrostatic precautions are required unless the sensitivity of the EO or materials require a conductive floor, in which case conductive precautions are to be observed during activities involving the sensitive EO or substances.

Use of Wrist and Leg Straps within Anti-static Regimes

2.69 Within an anti-static regime if wrist straps are specified for use, then the following standards are to be applied:

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11 Gloves are not to be worn unless as a result of a risk assessment, they are identified as Personal Protective Equipment (PPE) to protect operators from an additional hazard. In this situation it will be necessary to balance the relative risks between the explosives and other identified hazard.

12 When procuring Conductive Footwear a value of 100 x 10^3 ohms is to be specified as the upper limit of resistance of the product when new - see AS/NZS 2210.4:2000 Clause 7.1.

13 When procuring Anti-static Footwear a value of 100 x 10^3 ohms is to be specified as the lower limit of resistance of the product when new, in order to ensure some limited protection against dangerous electric shock or ignition in the event of any electrical apparatus becoming defective whe operating at voltages up to 250 V - see AS/NZS 2210.4:2000 paragraph 7.2. The resistance limits specified in AS/NZS 1020:1995 and AS/NZS 2210:2000 are not applicable to anti-static footwear procured for use in EO facilities and for the handling of EO and explosive substances that are sensitive to electrostatic discharge.

a. Wrist straps are to comply with BS IEC 61340, the wristband is to be of the quick release type. The end-to-end resistance (including the wrist strap, cabling and termination contact) is not to be less than 900 x 10^3 ohms and not greater than 35 x 10^6 ohms.

b. A dedicated connection point for wrist straps is to be established adjacent to the working area and must be easily accessible. The connection point is to be clearly identified.

2.70 Electrostatic dissipative leg straps should be constructed such that the contact made with both feet and legs meet the requirement for an electrical path from the wearer to contact points on each foot of the footwear in both toe and heel region.

Checking of Anti-static Equipment Prior to Use

2.71 Checking of wrist and leg straps is to be made at the start of each working day. Each check is to be made with the wrist strap worn on the wearer's wrist and in contact with the wearer's skin. Checking is to include the measurement of an 'end-to-end' resistance.

2.72 Leg, toe and heel straps are to be checked at the start of each working day. The wearer's leg strap is to be in contact with the wearer's skin. Toe and heel straps are to be tested with the appliance worn by the wearer.

Monitoring of Equivalent Body to Earth Resistance

2.73 Personnel entering facilities in which electrostatic precautions are to be observed, are to be monitored to ensure that their total resistance to earth through their protective footwear is within specified limits depending on the conditions that must prevail in the particular facility in question. Approved HAPTM (see paragraphs 2.76 to 2.83) are to be used for this monitoring process.

PROTECTION AGAINST ELECTRIC SHOCK

General

2.74 All electrical supplies to rooms fitted with conductive floors should be protected by Residual Current Devices (RCD) with a 10 mA tripping current, if personnel have access to the supplies whilst standing on a conductive floor. Portable electrical equipment used during building maintenance, ie when electrostatic precautions are not needed, must be similarly protected.

2.75 For test equipment maintenance where live conductors are exposed and it is impracticable to fit RCD because normal earth leakage from the equipment exceeds 10 mA, provision is to be made for some alternative means of protection, eg some form of insulating barrier such as insulating mats, such that the risk of a lethal electric shock is removed, in so far as is reasonably practicable. It is always to be the aim to use safe, well documented procedures, but if detailed documentation is not available, eg when 'trouble shooting' faults in equipment, personnel allocated to such tasks must have the practical expertise to perform the task safely.

HAZARDOUS AREA PERSONNEL TEST METERS (HAPTM)

General

2.76 The HAPTM is an instrument used in EO and electronic repair areas for monitoring the equivalent resistance to earth of personnel entering areas where electrostatic precautions are in force. This instrument must be used by all personnel, whether they are supervisors, operatives or visitors, who are required to enter rooms where static susceptible items are handled or exposed. Visitors equipped with temporary earthing devices (heel grounders etc) are permitted into conductive and antistatic areas but are not normally permitted to touch any explosives assembly.

2.77 A suitable HAPTM should be installed for use in rooms where electrostatic precautions are to be observed. If no HAPTM is installed, an alternative procedure for the protection of EO from ESD must be utilised to achieve the required protection. However, where users wish to upgrade to a Conductive Regime, the facility must include the addition of a HAPTM.

2.78 The method and siting of the HAPTM are important and will be governed by the type of meter used. HAPTM are normally to be placed inside the entrance to the work-room. The earth electrode is to be connected to the earth grid of the conductive or anti-static floor of the building. A metal earth plate is not be used as the foot electrode as this does not check the actual conditions within the building; personnel must stand on the conductive floor whilst testing resistance to earth. Uncertified HAPTM must be installed outside of hazardous areas.

2.79 Failure to pass within the specified safe range must be reported immediately and corrective action taken before personnel may start work.

Design Requirements

2.80 The enclosure for the HAPTM must satisfy the IP requirements for the Hazardous Area in which it is to be installed [14].

2.81 HAPTM are to operate with a test voltage of approximately 100V, limited to a maximum of 10mA short circuit current, to reflect the most sensitive hazard conditions. HAPTM are to alarm if a resistance greater than specified in paragraph 2.82 is obtained. HAPTM are to be maintained in accordance with the operating instructions.

2.82 HAPTM must be capable of adjustment to suit the combination of floors and footwear required for normal and maximum electrostatic precautions (see paragraphs 2.8 and 2.10). The pass ranges required, ie the equivalent body to earth resistances, are as follows:

Precautions Required	**Shoes**	**Floors**	**Equivalent Resistance Pass Range**
Maximum Electrostatic Precautions	0 - 150 x 10^3 ohm	0 - 50 x 10^3 ohm	1 x 10^6 ohm
Normal Electrostatic Precautions	100 x 10^3 – 50 x 10^6 ohm	50 x 10^3 – 2 x 10^6 ohm	20 x 10^6 ohm

NOTES

1. Although normal electrostatic precautions require anti-static shoes in conjunction with anti-static flooring, the floor resistance range quoted above includes conductive flooring to allow flexibility in the use of existing buildings. Anti-static shoes provide adequate protection against injury from electric shock even when the floor resistance is low.

2. Where HAPTM have a limited capability, the highest measureable resistance less than 20 x 10^6 ohms, within the HAPTM range, may be used in lieu of the upper limit for normal electrostatic precautions.

Calibration of HAPTM

2.83 HAPTM are to be calibrated at a frequency stated in the instrument handbook.

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[14] Hazardous Area Personnel Test Meter, Mk 2, NSN 6665-99-547-0584 (Unsealed Unit) manufactured to Drawing No AS 780045 by MOD (Navy), is approved for use in Defence EO Workshops for Zone 22E or Zone NHE only.

INSPECTION AND TESTING OF ANTI-STATIC PROTECTION SYSTEMS

General

2.84 The OIC of the Establishment is responsible for the periodic inspection and testing of electrostatic protection systems, including footwear, used in EO facilities. The requirements for these inspections and tests are detailed in paragraphs 2.86 to 2.94 inclusive.

2.85 The tests should be conducted in conjunction with other periodic tests necessary for building lightning protection systems and electrical installations (see Regulation 6.2 Procedure 1 and Regulation 6.3 Procedure 1). Testing intervals are to be chosen so tests are conducted at varying seasons of the year.

Inspection Requirements

2.86 Conductive and anti-static floors, bench top coverings, footwear, earth straps, etc, are to be examined at intervals not exceeding six months for excessive wear or mechanical damage.

Testing Requirements

2.87 The following tests are to be conducted on facilities and equipment used where electrostatic precautions are to be observed:

a. All mobile equipment is to be tested in accordance with Regulation 6.3 Procedure 3 before being taken into use, and six-monthly thereafter, to ensure that it provides a leakage path of resistance not exceeding 1×10^6 ohms through the equipment to earth.

b. All bonding and earthing is to be checked at regular intervals not exceeding those specified in Regulation 6.3 Procedure 1.

c. Conductive and anti-static flooring, bench top coverings and footwear are to be tested, at the intervals specified in paragraphs 2.89 to 2.91, in accordance with the requirements of Annex D. If any area of a floor or bench fails to pass the required test the whole floor or bench is deemed to have failed the test.

d. When pipes and/or other metal parts are replaced after repairs, etc, tests are to be carried out to ensure that the connection to earth is continuous throughout the total length of the pipe or other metal parts.

e. Drive and conveyor belts used for the movement of static sensitive explosive substances or EO are to be of the anti-static type and comply with the requirements of AS 1332 and AS 1334.9. The maximum acceptable resistance is 100×10^3 ohms.

Safety Precautions During Testing

2.88 The safety precautions prescribed in Regulation 6.3 Procedure 1 are to be observed during electrical testing of electrostatic protection systems fitted to buildings.

Frequency of Testing

2.89 **Conductive Flooring and Bench-top Coverings.** New conductive floors and bench-top coverings are to be tested on installation and 3 and 9 months later; thereafter tests are to be made at intervals of between 10 and 14 months (also see paragraphs 2.86 and 2.91). Where there is evidence of excessive wear or deterioration of floors or bench-top coverings this is to be reported and the interval between tests is to be reduced to between 5 to 7 months. These testing requirements are also applicable to existing conductive flooring or bench-top coverings.

2.90 **Anti-static Flooring and Bench-top Coverings.** New anti-static floors and bench-top coverings are to be tested on installation. The floor surface is to be dry unless the test indicates a value less than 100 x 10^3 ohms, in which case, the floor surface should be locally wetted at each electrode site in accordance with BS 3187 Appendix D. After initial installation test, anti-static floors are to be tested at intervals of between 10 and 14 months (also see paragraphs 2.86 and 2.91). Where there is evidence of excessive wear or deterioration of floors or bench-top coverings this is to be reported and the interval between tests is to be reduced to between 5 to 7 months. These testing requirements are also applicable to existing anti-static flooring or bench-top coverings.

2.91 **Conductive and Anti-static Footwear.** All conductive and anti-static footwear, including leg-stats, is to be tested when new, ie before being put to use, and subsequently at intervals of not greater than 12 months. If conductive footwear is checked before use with a HAPTM to indicate when the resistance limits for the floor/footwear combination are outside the permitted range, there is no need for an annual test. Should failures occur on HAPTM monitoring then footwear may need to be tested to establish the cause of the failures.

2.92 **'Test Due' Dates.** The date when the next test is due for the electrostatic protection systems (floors and benches) installed in the building is to be marked as required at Regulation 6.3 Procedure 1.

Recording of Test Results

2.93 Detailed results of all tests conducted on electrostatic protection systems are to be obtained from the Testing Agency and maintained so that comparisons from test to test may be made. Accordingly, initial test results of new or modified installations are of particular importance.

2.94 Initial test results of new or modified electrostatic protection systems installed in a facility are, in every instance, also to be recorded in the Acceptance Report for that facility.

Annexes:
A. Explosives and Explosive Articles requiring Maximum Electrostatic Precautions
B. List of Related Regulations and Standards
C. Effects of Relative Humidity on Electrostatic Safety
D. Determination of and Limits for the Electrical Resistance of Electrostatic Protection Flooring, Bench-top Coverings and Footwear
E. Earthing Policy for Weapons

ANNEX A

EXPLOSIVES AND EXPLOSIVE ARTICLES REQUIRING MAXIMUM ELECTROSTATIC PRECAUTIONS

1. This Annex gives guidance on explosive substances and explosive articles that require maximum electrostatic precautions to be taken when they are exposed or handled.

2. The criteria used are compositions such as initiatory and pyrotechnic substances with spark sensitiveness of less than 1 milli-joule (mJ) or an Electro-Explosive Device (EED) that may be initiated by an energy level of less than 1 mJ. These items are referred to as 'sensitive' compositions or EED.

3. The static sensitivity data for explosive substances is given on the Hazard Data Sheet/Safety Certificate for that explosive. However, many Hazard Data Sheets/Safety Certificates do not show electrical discharge sensitivity below 45 mJ. In the absence of other data, materials with an electrical discharge sensitivity below 45 mJ should be considered as requiring maximum electrostatic precautions.

4. The following list provides a guide to some typical substances and articles that require maximum electrostatic precautions. Absence from this list does not necessarily mean that an explosive substance or EED is not static sensitive:

a. All initiatory compositions and conducting compositions.

b. Pyrotechnic compositions as follows:

(1) Delay compositions (gasless) based on boron as fuel and lead dioxide, or chromium, bismuth and molybdenum trioxides as oxidants, eg SR 10, SR 11, SR 54, SR 57, SR 61, SR 75, SR 79, SR 87, SR 89, SR 90 and SR 92.

(2) Igniter and primary compositions based on either zirconium as fuel with molybdenum and chromium trioxides as oxidant or aluminium and/or magnesium as fuel with tungsten trioxide as oxidant, eg SR 45, SR 46, SR 47 and SR 70.

(3) Flame compositions based on titanium as fuel, eg SR 697, SR 698 and SR 699.

c. Conducting composition and thin film bridge EED. These are sensitive to a few micro-joules of energy and maximum electrostatic precautions are essential.

5. Some bridge-wire EED can be ignited by only a few milli-joules of energy. It is therefore desirable to use maximum electrostatic precautions when any bridge-wire EED is exposed or handled.

6. Consideration needs to be given to the sensitiveness of explosive material during processing that may differ from the sensitiveness of the end product. For example, processing of fine metal powders in the presence of flammable solvents may lead to conditions very sensitive to ignition by static discharge.

ANNEX B

LIST OF RELATED REGULATIONS AND STANDARDS

Australian Standards (AS) and Australian/New Zealand Standards (AS/NZS)

AS/NZS 1020	The Control of Undesirable Static Electricity
AS 1319	Safety Signs for the Occupational Environment
AS 1332	Conveyor Belting – Textile Reinforced
AS 1334	Methods of Testing Conveyor and Elevator Belting, Part 9 – Determination of Electrical Resistance of Conveyor Belting
AS/NZS 2210	Occupational Protective Footwear

British Standards

BS 2050	Electrical Resistance of Conducting and Anti-static Products made from Flexible Polymeric Material
BS 3187	Specification for Electrically Conducting Rubber Flooring
BS EN 1149	Protective Clothing – Electrostatic Properties
BS IEC 61340	Electrostatics

Department of Defence Publications

Defence Science and Technology Organisation – Miscellaneous Reports

Ordnance Board Proceedings

Pillar PROC 101	Electrical/Explosives Hazards – Principles of Design and Use of Electrical Circuits incorporating Explosive Components

UK Ministry of Defence Publications

Explosives Hazard Assessment Manual of Tests of the Explosives Sensitiveness Collaboration Committee

Joint Service Publication (JSP) 482 MOD Explosives Regulations Volume 1, Chapter 8 Safety Standards for Electrical Installations and Equipment in Explosives Facilities

Miscellaneous Publications

NATO STANAG 4235	Electrostatic Environment Conditions Affecting the Design of Material for Use by NATO Forces

ANNEX C

EFFECTS OF RELATIVE HUMIDITY ON ELECTROSTATIC SAFETY

1. Absolute humidity is the quantity of water vapour, by weight, contained per unit volume of air. Relative Humidity (RH) is the ratio of water vapour pressure in air to the saturated (maximum) water vapour pressure at the same temperature of air. Increasing the humidity of the air in a room does not significantly increase its conductivity. However, an increase in the relative humidity will promote the ability of the air to 'wet' the surface of some materials. The moisture absorbed on the surface of material will greatly increase its surface conductivity, especially if contaminants on the surface dissolve to form an electrolyte.

2. Because electrostatic charging is a surface phenomenon, the hygroscopicity of the material is crucial. Consequently, higher air humidity is a preventative measure against static charging but only for hygroscopic materials. In practical terms, natural cellulose products, eg cotton, will only retain charge at low RH values, whilst materials such as Polytetrafluoroethylene (PTFE), can retain significant levels of charge at values in excess of 65% RH.

3. Most of the literature states that the fundamental measure is relative humidity rather than absolute humidity. This is because the relative humidity indicates the tendency of the air to release its moisture to material surfaces. Certainly, warm rooms in winter will dry surfaces rapidly as air drawn from the outside warming up shows a drastic reduction in RH. For this reason, winter conditions favour the accumulation of indoor static charges. The temperature of the surfaces further complicates these effects, ie cold surfaces will tend to condense moisture, whilst hot surfaces will dry.

4. In summary, the effect of reducing RH, is to reduce the quantity of water on the material's surface, thereby increasing it's surface resistivity by several orders of magnitude – see Figure 2–C–1. It also increases contact resistance.

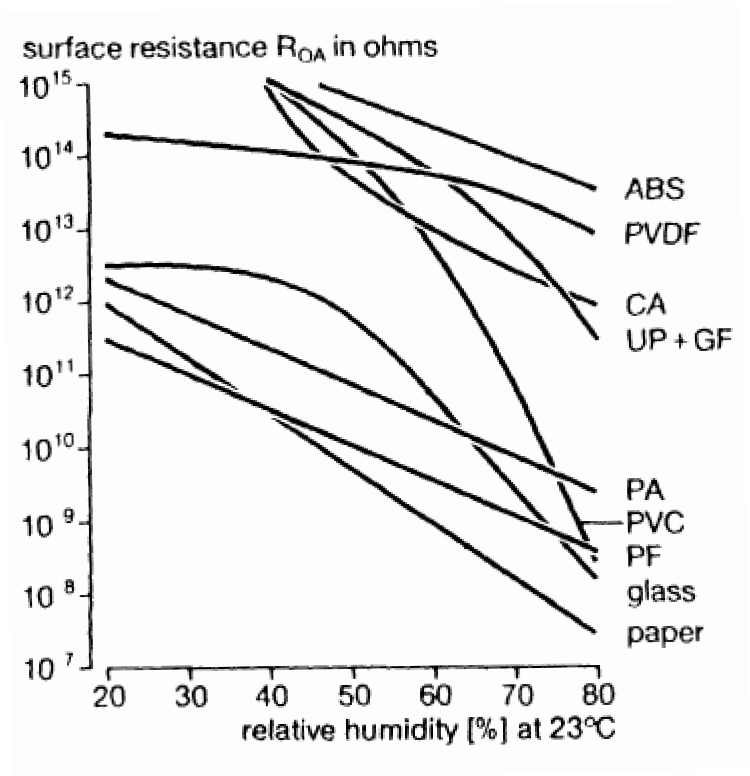

Figure 2–C–1 Graph Showing Surface Resistance in Relation to Relative Humidity

ANNEX D

DETERMINATION OF AND LIMITS FOR THE ELECTRICAL RESISTANCE OF ELECTROSTATIC PROTECTION FLOORING, BENCH-TOP COVERINGS AND FOOTWEAR

Conducting Flooring

1. **Reference Document.** The electrical resistance of conducting flooring is to be determined in accordance with Appendix D of BS 3187:1978, except that the open circuit test voltage is not to exceed 100 + 2V DC.

2. **Apparatus.** The following apparatus is required:

a. A tester having an open circuit voltage of 100 + 2V DC, or any suitable instrument that gives comparable results. The instrument is not to dissipate more than 3W in the flooring.

b. A clean metal (brass, copper or stainless steel) electrode of diameter 25 + 1.0 mm and a mass of 225 + 15g.

3. **Preparation for Test.** Prepare for the test as follows:

a. The surface of the floor to be tested is to be cleaned and dried. Suitable cleansing materials are Fuller's Earth followed by distilled water. In no case is the surface to be buffed or otherwise abraded, and materials liable to cause the flooring to swell during the period of application are not to be used.

b. Allow the floor surface to dry.

4. **Testing.** At the chosen test point a liquid electrode approximately 25 mm square is to be formed by applying a mixture of four parts by mass of polyethylene glycol (molar mass 600), one part by mass of water and approximately 0.005 parts by mass of wetting agent. The metal electrode is to be placed on the wetted area. Combined electrodes consisting of a metal electrode enclosed in a moistened pad may be used in place of the metal electrode/liquid system. The resistance between the electrode and a known earth is to be measured while applying a load of 45N to the electrode. The time of test is not to be longer than is necessary for obtaining a stable reading.

5. **Number and Location of Tests.** One test is to be made in each area of floor of 1.5 m x 1.5 m dimensions, at places chosen so that the tests will be representative of the electrical properties of the whole area, in particular, those areas subject to hard usage. While there is merit in using different test points in order to spread the tests over the whole floor, approximately half the measurements should be made in the same locations at each test so that any tendency to change can be established and monitored. One test should be located at the HAPTM position if the floor is used as one test electrode.

6. **Test Limit.** Each measured resistance of the conducting floor surface to earth must be less than 50×10^3 ohms. The final resistance measurement quoted is to be the average of all the readings taken.

Anti-static Flooring

7. Anti-static flooring is to be tested in the same manner as for conducting flooring (see paragraphs 1 to 5 above), except that:

a. The open circuit voltage of the tester is to be 500V DC.

b. The floor surface is to be dry, unless the test indicates a value between 50×10^3 ohms and 100×10^3 ohms in which case the floor surface is to be wetted as given at sub-paragraph c.

c. A liquid electrode approximately 25 mm square on the flooring is to be formed by applying a mixture of four parts by mass of polyethylene glycol (molar mass 600), one part by mass of water and approximately 0.005 parts by mass of wetting agent. The metal electrode is to be placed on the wetted area. Combined electrodes consisting of a metal electrode enclosed in a moistened pad may be used in place of the metal electrode/liquid system.

8. **Test Limits.** Each measured resistance of the anti-static floor surface to earth must be between 50×10^3 ohms and 2×10^6 ohms. The final resistance measurement quoted is to be the average of all the readings taken.

Bench-Top Coverings

9. **Test Method.** The electrical resistance of conducting or anti-static bench-top coverings is to be determined as for conducting or anti-static floor coverings, as appropriate.

10. **Number and Location of Tests.** Tests are to be made on every 1.0 m^2 of the bench space at places chosen to be representative of the electrical properties of the whole bench-top, in particular, the areas subject to hard usage.

11. **Test Limit.** Each measured resistance of the bench-top covering surface to earth must be less than 1×10^6 ohms. The final resistance measurement quoted is to be the average of all the readings taken.

Conducting Footwear

12. **Reference Document.** The electrical resistance testing of conducting footwear is to be conducted in accordance with Australian/New Zealand Standard AS/NZS 2210.2:2000 *Occupational Protective Footwear – Requirements and Test Methods*.

13. **Test Method.** The electrical resistance of conducting footwear is to be measured in accordance with the test method specified in AS/NZS 2210.2:2000, Section 5.7. The testing instrument is to have an open circuit test voltage not exceeding 100 + 2V DC[1] and is not to dissipate more than 3W in the footwear.

14. **Test Limits.** The measured resistance of conducting footwear must be less than 100×10^3 ohms in its new state, and less than 150×10^3 ohms during service.

Anti-static Footwear

15. **Reference Document.** Anti-static footwear is to be tested in accordance with AS/NZS 2210.2:2000.

16. **Test Method.** The electrical resistance of anti-static footwear is to be measured in the same manner as for conducting footwear at paragraph 13.

17. **Test Limits.** The test limits specified in AS/NZS 2210 are not applicable to anti-static footwear procured for use in EO facilities and for the handling of EO and explosive substances that are sensitive to electrostatic discharge. For these purposes the measured resistance of anti-static footwear must be between 100×10^3 ohms and 5×10^6 ohms.

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[1] This is the maximum voltage permissible on personnel that will void an ignition hazard to the most sensitive explosive substances and articles.

ANNEX E

EARTHING POLICY FOR WEAPONS

1. The overwhelming majority of weapons (ie fully assembled missiles and conventional weapons in their normal Service packs) do not require deliberate earthing from electrostatic discharge while in storage. Any exceptions are well defined and documented. The non-earthing policy does not necessarily apply however, for sub-assemblies or static sensitive stores in an unprotected state.

2. To provide protection from side-flashing during a lightning strike no explosive stores or non-explosive stores that could be damaged by electrical discharge (eg electrical equipment and flammable liquids) are to be located within 500 mm of any conductor forming part of the aboveground lightning protection system. This is to include any metal cladding of an outer wall that is earthed and bonded to the lightning protection system. Any metal objects such as conduits, ducts, metal rails, racks or cranage located within 500 mm of the system may also act as side flash conductors. The 500 mm rule will also apply to these conductors. Cranes bonded to the lightning protection system in the building will not comply with these requirements when stores are being handled with wire strops. Whilst it is most unlikely that a lightning strike will find its way to earth via the crane as opposed to the shortest route via the side of the building, such operations are to cease during a thunderstorm. If mains electricity supplies are used in contact with any of the above items it may be necessary to earth the metal work as a protection against mains electrical insulation failure.

3. The minimum separation distance stated in paragraph 2 is not required in underground buildings, or in earth covered buildings, if the lightning conductor system complies with Regulation 6.2 Procedure 1.

4. Earthing during transport, handling and processing operations is to be in accordance with the individual weapon processing documentation. The following general requirements, however, are applicable:

a. During assembly or disassembly each individual section of a weapon must be continuously earthed. In addition, personnel performing assembly/disassembly operations must be earthed by way of conductive shoes or conductive floors or other earthing or bonding methods if the possibility exists that exposed explosives, flammable gases or liquids or exposed EED or exposed EED contacts will be present (see Regulation 6.3 Procedure 2 for details). Inert components of weapons require earthing only prior to mating with explosive components under the preceding conditions;

b. During all phases of checkout, the weapon or separate section is to be earthed. Personnel utilising electrical mains powered test equipment should not be earthed at any time when the possibility of electric shock hazard exists. However, they are to bring themselves to the same electric potential as the weapon by touching the skin of the weapon with a bare hand prior to touching any contacts that may serve as a path to conduct electrostatic charges to any EED. Caution must be exercised to ensure the ordnance earth lead, when fitted, is not connected to the building/electric earth inside the building and is only connected to the ordnance earth point;

c. In all cases, precautions must be taken when working on a weapon to avoid ground loops such as those that could be caused when a store is earthed through both the crane cable and hook and a conductive strap to the conductive floor or ordnance earth; and

d. During certain explosive ordnance tests it is necessary to connect the weapon to electrical test sets which are externally powered. In these cases it is permissible to disconnect the weapon from the ordnance earth system during the tests provided the weapon is equipped with a mechanical out-of–line safing device and the EED in the circuit being tested are out-of-line or the EED are not brought into line except in a test cell after all personnel have been withdrawn.

5. Many of the older conventional process buildings have receipt lobbies that cannot meet the physical separation distance required at paragraph 2. Also, the space available within the processing area of such buildings is very limited, particularly if special equipment is fitted, eg breakdown apparatus. In these buildings, the separation distance stated in paragraph 2 is to be provided wherever physically possible. Local orders should state that in the event of a thunderstorm warning and subsequent instructions to put stores ‘under cover’, no stores should be left within 500 mm of the building wall or of any metal roof support pillars which may be an integral part of the conducting system.

PROCEDURE 3 - ELECTRICAL REQUIREMENTS FOR MECHANICAL HANDLING EQUIPMENT AND VEHICLES FOR USE IN EXPLOSIVE AREAS

Introduction

3.1 Vehicles, mobile Mechanical Handling Equipment (MHE), portable generating sets, pump motors and mobile lifting or stacking appliances powered by internal combustion engines may present a hazard to personnel to Explosive Ordnance (EO) by sparks from electrical or exhaust systems causing fire. The requirements of this instruction have been prescribed to minimise such hazards when this equipment is used within, or close to, EO facilities.

Purpose

3.2 This procedure prescribes the conditions for use of vehicles and MHE in Explosive Handling Areas (EHA) and their standards of construction.

Complimentary Instructions

3.3 Complimentary instructions that specify additional requirements for MHE and Vehicles can be found in Regulation 4.6 Procedure 2. This procedure details instructions for the hazards associated with the use of combustible engines and for the use of this handling equipment within EHAs.

Responsibility for Category and Zone requirements

3.4 It is the responsibility of the user to specify the category and zone requirements applicable to vehicles and MHE for use in a Potential Explosion Site (PES), and to confirm that the required standards are obtained.

Zoning of Potential Explosion Sites

3.5 Regulation 6.3 Procedure 1 classifies buildings containing EO according to the nature of EO stored, handled or processed in the building. Electrical installations and equipment are afforded the same category as the building in which they are installed or used. The same system is used to determine the protection to be afforded to vehicles and MHE permitted inside buildings containing EO, as follows:

a. **Zone 0E.** Vehicles and powered mobile MHE are not permitted in Zone 0E environments.

b. **Zones 1E, 2E, 20E, 21E, 22E and 33E.** Military diesel powered vehicles, diesel powered mobile MHE, electrically powered vehicles and electrically powered mobile MHE are permitted in Zones 1E, 2E, 20E, 21E, 22E and 33E environments, provided they meet the specifications detailed in Annex A.

c. **Restricted Electrical Areas.** Military diesel powered vehicles, diesel powered mobile MHE, electrically powered vehicles and electrically powered mobile MHE are permitted in Restricted Electrical Area (REA) environments, provided they meet the specifications detailed in Annex B.

3.6 **Compatibility of Vehicles and Environments.** Different categories of military diesel powered vehicles, diesel powered mobile MHE, electrically powered vehicles and electrically powered mobile MHE, are in some cases compatible, although some are not.

3.7 The following matrix clarifies the compatibility of the different standards of enclosure.

Design Category of Vehicle	Acceptability within other categories of EO Facilities							
	Zone 0E	Zone 1E	Zone 2E	Zone 20E	Zone 21E	Zone 22E	Zone 33E	REA
Zone 0E	YES	YES	YES	NO	NO	NO	YES	YES
Zone 1E	NO	YES	YES	NO	NO	NO	YES	YES
Zone 2E	NO	NO	YES	NO	NO	NO	YES	YES
Zone 20E	NO	NO	NO	YES	YES	YES	YES	YES
Zone 21E	NO	NO	NO	NO	YES	YES	YES	YES
Zone 22E	NO	NO	NO	NO	NO	YES	YES	YES
REA	NO	NO	NO	NO	NO	NO	NO	YES

Table 3–1: Compatibility of Vehicles and Environments

Vehicles and MHE Authorised to Enter a Potential Explosion Site

3.8 Electrically operated vehicles and MHE, including lifting or stacking appliances, are preferable from a safety viewpoint to those operated by internal combustion engines for use in EO facilities. Electrically operated vehicles and powered mobile MHE are permitted in a PES under certain specific conditions.

3.9 Notwithstanding paragraph 3.7, a standard vehicle or powered mobile MHE, may be brought into an EO area, in particular into a holding yard or marshalling yard, subject to the restrictions detailed in Annex B.

3.10 Details of the construction of petrol and diesel engine vehicles that are intended for the conveyance of Government and Visiting Forces' EO by road outside EO areas, are contained in Explosives Transport Regulations 2002. These vehicles are not permitted into PES except as provided for in Annex B.

GENERAL DESIGN, CONSTRUCTION AND SPECIFICATION REQUIREMENTS FOR VEHICLES AND POWERED MECHANICAL HANDLING EQUIPMENT FOR USE IN A PES

General

3.11 Vehicles and powered mobile MHE authorised for use within a PES are to conform, as a minimum, to the standards set out in Annexes A and B. It is not to be assumed that a vehicle compliant for use within an explosive vapour and gas atmosphere is suitable for use within an environment with an atmosphere of dusts of explosives. It can be assumed that a vehicle compliant with Annex A is suitable for a REA environment. In addition to these standards the criteria in paragraphs 3.11 – 3.14 are to be observed.

Identification of Mechanical Handling Equipment

3.12 Mobile MHE, including cranes, are to be clearly identified by sign writing, plating or other suitable means to define the facilities in an EO area in which it is cleared for use.

Tyres

3.13 The tyre of at least one road wheel is to be electrically conducting in accordance with the requirements of BS2050:1978, Table 2, Item 8. All wheels on any one axle are to be fitted with tyres of the same type.

Ancillaries

3.14 Ancillary items in use with vehicles and powered mobile MHE are to comply with the equivalent standards as the main equipment with which they are utilised.

Electromagnetic Compatibility

3.15 All vehicles and powered MHE must be compliant with the requirements of DEF STAN 59-41.

Battery Charging

3.16 The batteries of electrically powered vehicles and electrically powered mobile MHE are to be maintained and charged at authorised locations that are aboveground and well ventilated. After battery charging the MHE must stand for a period of one (1) hour before entering an EO facility.

Annexes:

A. Special Constructional Requirements for Vehicles and Mechanical Handling Equipment used in Zones 1E, 2E, 20E, 21E, 22E and 33E

B. Special Constructional Requirements for Vehicles and Mechanical Handling Equipment used in Restricted Electrical Areas

ANNEX A

SPECIAL CONSTRUCTIONAL REQUIREMENTS FOR VEHICLES AND MECHANICAL HANDLING EQUIPMENT USED IN ZONES 1E, 2E, 20E, 21E, 22E AND 33E

1. Pending the development of appropriate specifications for vehicles and mechanical handling equipment to operate in Zones 1E, 2E, 20E, 21E, 22E and 33E hazardous areas the following applies:

a. Vehicles and mechanical handling equipment certified before 1 September 2006 to operate in Zones 1E, 2E, 20E, 21E, 22E and 33E hazardous areas may continue to be operated within such environments; and

b. From 1 September 2006 no vehicles and mechanical handling equipment are permitted to be operated in Zones 1E, 2E, 20E, 21E, 22E and 33E hazardous areas unless prior approval is obtained from the Directorate of Ordnance Safety.

ANNEX B

SPECIAL CONSTRUCTIONAL REQUIREMENTS FOR VEHICLES AND MECHANICAL HANDLING EQUIPMENT USED IN RESTRICTED ELECTRICAL AREAS

Vehicles and Powered MHE Authorised to Enter a PES (All Areas) with a Restricted Electrical Area Operating under Regulation 4.4 Procedure 5

1. Military diesel powered vehicles, diesel powered mobile MHE, electrically powered vehicles and electrically powered mobile MHE are authorised to enter a PES with a restricted electrical area (REA) in order to handle EO subject to the following restrictions:

a. An approved spark arrestor is to be fitted to the exhaust system;

b. The maximum temperature of the exposed surfaces of the vehicle or powered mobile MHE is not to exceed 135°C. This requirement may be met by shielding which is designed to prevent explosives coming into contact with any surface whose temperature exceeds 135°C;

c. The surface temperatures of components under the covers of the powered mobile MHE in its normal operating condition is to be as low as practicable and must not exceed T3 (200°C);

d. The air intake system is to be fitted with a dry air cleaner;

e. When a cold starting aid which ignites fuel in the air intake manifold is fitted, an approved flame trap is to be fitted between the air cleaner and the cold start device; and

f. The engine must be fitted with oil pressure loss, coolant loss and high temperature warning devices, or an automatic shut down device.

Vehicles and Powered MHE Authorised to Enter a PES (All Areas) with a Restricted Electrical Area Operating under Regulation 4.4 Procedure 7

2. Unprotected military diesel powered vehicles, diesel powered mobile MHE, electrically powered vehicles and electrically powered MHE may be authorised to enter a PES with a REA operating under Regulation 4.4 Procedure 7 subject to the following restrictions:

a. The PES is to be solely authorised as an EO preparation facility under a particular licence[1]; and

b. The unprotected powered vehicle is to be utilised only for EO preparation tasks undertaken in the licensed facility.

Vehicles and Powered MHE Authorised to Enter a PES (Storage, Holding Yard or Marshalling Yard Only) with a Restricted Electrical Area for the Purposes of Loading or Unloading

3. Unprotected military diesel powered vehicles, diesel powered mobile MHE, electrically powered vehicles and electrically powered mobile MHE may be authorised to enter a PES with a REA or enter the confines of a holding yard or marshalling yard. The following restrictions apply:

a. The PES, holding yard or marshalling yard is to be solely authorised for the storage and handling of ESTC classified EO but not processing; and

b. Only handling, loading and unloading of ESTC classified EO in their approved ESTC packaging may be undertaken by the unprotected, powered MHE.

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[1] If control of a PES is transferred from one user to another the transfer is to be documented in a HO/TO certificate with a copy being retained by both users.

ANNEX B

Unprotected Vehicles Required to Enter a PES, Holding Yard or Marshalling Yard in order to be Loaded or Unloaded with Explosive Ordnance for Onward Transit

4. Unprotected military diesel powered vehicles, electrically powered vehicles, trucks and lorries may be authorised to access the entrance of a PES or enter the confines of a holding yard or marshalling yard, subject to the following restrictions:

a. The PES, holding yard or marshalling yard is to be solely authorised for the storage and handling of ESTC classified EO but not processing;

b. The unprotected vehicle is to be utilised solely for the role of receipt or despatch of ESTC classified EO in their approved ESTC packaging; and;

c. The unprotected vehicle engine is to be stopped before loading or unloading commences and it is not to be restarted until the operation is complete and all EO is secured.

Inspection of Unprotected Vehicles and Powered MHE

5. When unprotected vehicles are used in non-hazardous atmosphere PES the following applies:

a. The unprotected vehicle is to be inspected by a competent person to ensure that it is without defects before the vehicle is allowed to enter the EO area. Particular attention is to be given to the fuel, electrical and exhaust systems, ensuring that no leaks or hazardous condition exists; and

b. Should the unprotected vehicle be observed to emitting sparks, its engine is to be stopped, the explosive packages offloaded prior to its immediate removal from the EO area.