RTM322 Clevis Pin Assembly

Component review 2017
Purpose

• To provide an overview of an MRH90 engine system component which has been the root cause of a number of technical events since introduction into service.

• This presentation is not intended to judge the design or effectiveness of the component in its current application or any future changes intended to improve reliability.
Contents

• RTM322 engine IGV/VSV Clevis Pin Assembly
• Inlet Guide Vane & Variable Stator Vane System Overview
• Technical events and outcomes
• Future improvement
Inlet Guide Vane & Variable Stator Vane Clevis Pin Assembly

Description / Location / Function
Clevis Pin – Description

Key features:
• Made of corrosion resistant steel.
• Comprised of three parts:
  – Clevis pin
  – Pivot roll pin
  – Spring clip locking device
• Designed for practicality and ease of removal/installation.
• Allows rapid disconnection from actuator to enable physical check of IGV/VSV mechanical linkage movement.

Difficult to install/inspect on MRH90 righthand engine installation
Clevis Pin – Description (sub parts)

Spring clip (2)

Clevis pin (1)

Hinge pin (3)
Clevis Pin - Location
Clevis pin - Function

- Connects Actuator (1) to Connecting link (3).
- Transfer point for hydraulic control by FADEC to control by mechanical linkages.
- Serviceability of Clevis pin determined by Spring clip dimension ‘X’ and roll pin security.

‘X’ must be greater than 5mm
Inlet Guide Vane & Variable Stator Vane System
Overview

Function / Description / Operation
Inlet Guide Vane & Variable Stator Vane (IGV/VSV) System

Function
Modify the angle of attack of the compressor inlet blades to:
• Control airflow into the compressor
• Regulate air path performance
• Prevent blade surge / compressor stall at low NG
• Provide feedback signal to FADEC
IGV/VSV System

Description

The system includes:

- 23 x variable Inlet Guide Vanes (IGV)
- 31 x Variable Stator Vanes (VSV)
- 2 x Actuating rings and vane control levers
- 1 x Actuator (IGV/VSV Actuator)
- Mechanical linkages – bellcranks, control rods
- 1 x Clevis pin

Operation

- Regulated by power demand from pilot via collective lever movement.
- IGV/VSV Actuator controlled by the FADEC.
- Actuator utilises fuel from engine HP pump as hydraulic medium to move piston.
- Actuating rings rotate simultaneously around the exterior compressor casing to move vane levers.
- Vane lever movement varies vane angle to regulate airflow into compressor.
IGV/VSV System Components

Actuator type: Electro-hydraulic
Operating fluid: Fuel
Control: By the DECU
IGV/VSV Mechanical Operation

- FADEC signal moves IGV/VSV Actuator.
- Movement imparted to Control lever at Clevis.
- Movement transmitted to IGV and VSV Actuator ring rods.
Technical Events and Outcomes

Notable events
Notable Event - 1
IGV Clevis pin dislodgment

08 April 2014 – A40-003 During approach for a roll-on landing at approx 15' above ground the master warning activated and ENGDF illuminated. Aircraft landed safely.

• No.2 engine IGV Clevis pin found on upper deck during after flight servicing.
• No.2 engine IGV linkages very stiff to operate by hand.
• Initial investigation concluded dislodgement due to incorrect installation of Clevis pin/ mechanical stiffness.
• OEM consulted, engine inducted for further investigation.
Notable Event - 2
IGV Clevis pin dislodgment

15 August 2014 – A40-003 During approach to the landing pad the ENGDF warning illuminated. Aircraft landed safely.

- No.2 engine IGV Clevis pin found on upper deck during after flight servicing.
- Damage to Clevis pin Spring clip and IGV Control lever indicated contact.
Airbus investigation

Investigation by Airbus maintenance facility (Brisbane) following second event confirmed:

• Clevis pin Spring clip jammed against the Control lever during operation.
• Contact distorted and released Spring clip.
• Several trials carried out.
• Result was the same with:
  – damaged Clevis pin (Test video 1)
  – brand new Clevis pin (Test video 2)
• Alternate installation successfully trialled by relocating Spring clip to opposite position (Test video 3) with no jamming or distortion evident.
Post investigation – Immediate resolution

- August 2014 - SAFRAN HE issued Technical Concession #1387820 authorising reorientation of Spring clip on all engines fitted to ADF MRH90 fleet
- Incorporated as mod 7210.023-267
Final outcome

- SAFRAN HE released service bulletin early 2015 implementing change as standard configuration on RTM322 01/9 variant.
- No issues reported since change incorporated.
Other Notable Issue - IGV Clevis roll pin dislodgment

**2010** – service bulletin issued to check all Clevis assemblies for loose unsecured roll pin.
- Linked to a manufacturing batch issue.
- Nil defects found in ADF fleet or stocks.

**2016** – service bulletin up-issued after report from foreign operator that roll pin had separated in flight allowing Clevis pin to disengage.
- Service bulletin mandates roll pin must be checked for security and lockwired whenever Clevis pin installed.

Ongoing issue to be resolved by modification
Future improvement
Proposed modification

• 1Q2017 Service bulletin issued by SAFRAN HE to replace Clevis pin with bolt and self-locking nut.
• Presently in approval loop with NHI and user nations.
• If approved will be introduced as RTM 322 01/9 engine modification C3116.
• Release anticipated mid 2017.

Solution still difficult to install on right hand engine on MRH90
Questions?