ADF Propulsion Systems Symposium 2017

Lighting in Inspection

“Now you see, now you don’t”

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Seminar Outline

The proper lighting for an inspection is like a “black magic”.

This seminar will help you to understand how to use light to see defects, color, texture and/or markings on parts focusing on:

- Inspection Light Color
- Inspection Light Intensity
- Inspection Light and Camera Angles

“Beware of false knowledge; it is more dangerous than ignorance.”
George Bernard Shaw
Special Thanks to Dollard and Pilsun at Materials Laboratory in Standard Aero in Winnipeg for images and support.

Thank You
COLOR

All pictures from digital camera with Automatic White Balance,
No post processing color correction applied.
The question is:

WHAT IS LIGHT?
Light is ...

Electro-Magnetic radiation in the range of 380-760 nano-meters which is response range of the human eye.
Color of light
Color of light
Color of light

Halogen lamp
CCT = 3000K

LED lamp
CCT = 5000K

CCT = Correlated Color Temperature
Color of light

- Only LED light on
- LED light on + room incandescent light on
Color of light

• First decision: **WARM** or **COOL**?

  – Consider finishes of the parts,
  
  – **Color appearance under inspection light,**
    
    e.g. bluish light (daylight 5000K+ can emphasize imperfections in chromium plating over nickel plating.

  – proximity to other light sources
INSPECTION LIGHT
INTENSITY
Microscope lighting setup

“The voyage of discovery is not in seeking new landscapes but in having new eyes.”
Marcel Proust
Beware – more light may not help to detect defects.
Inspection Light Intensity
Inspection Light Intensity

90 deg

90 deg extra light
Inspection Light Intensity

Filter “wrong direction”

Filter “right direction”
Inspection Light Intensity

Camera tilt worked the best.
Inspection Light Intensity, Filters

90 deg

Filter “wrong direction”

90 deg extra light

Filter “right direction”
Inspection Light Intensity, Filters
Inspection Light Intensity, Filters
Inspection Light Intensity

“Less is more” in inspection lighting.
INSPECTION LIGHT & CAMERA ANGLE

“There are two ways of spreading light: to be the candle or the mirror that reflects it”

Edith Wharton
How light interact with different surfaces

Specular

Spread

Diffuse
Inspection Light & Camera Angle
Inspection Light & Camera Angle
Inspection light and camera angle

- Focused light
- Diffused light
- Top lighting technique
Inspection light and camera angle

45deg perpendicular

45deg parallel
Inspection light and camera angle

Oblique perpendicular

Oblique parallel
Inspection light and camera angle

45deg
Oblique
Top lighting
Diffused light
“Now you see, Now you don’t”
Summary – lighting for an inspection:

• Most effective is selection of **Light Direction** - best if light is perpendicular to a defect

• **Light Intensity** – “less is more”

• **Light Color** - use lamps with higher CCT
  – 4000K (Cool White) or 5000K (Daylight).
  – Be aware of “stray” light.

• Follow **OEM instructions** for inspection (if provided)

“We live in a society exquisitely dependent on science and technology, in which hardly anyone knows anything about science and technology.”

Carl Sagan (American astronomer)
QUESTIONS?

“Judge a man by his questions rather than by his answers.”
Voltaire

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