

# Aerospace Fiber Optics

AFO 101, Session 6

***Fiber Optic Testing***

# Session Objectives

At the completion of this session, you should be able to:

- Determine light loss budget for cable assemblies.
- Properly perform an optical loss test.

# Session Agenda

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## Light Loss Testing

- Budget
- Set up
- Process

# Testing: Light Loss Testing

| <b>Optical Test Probe / Reference Cable</b> | <b>Mating or Alignment Sleeve</b>           | <b>Optical Test Probe/ Reference Cable</b> |
|---|---|--|
| ST to ST reference cable                    | ST mating sleeve                            | ST to ST reference cable                   |
| ST to LC reference cable                    | LC mating adaptor                           | ST to LC reference cable                   |
| ST to SMA reference cable                   | SMA mating sleeve                           | ST to SMA reference cable                  |
| Tempo F13K-106-03 FoPro                     | Built-in Adaptor                            | Tempo F13K-106-03 FoPro                    |
| Tempo F23K-106-03 FoPro                     | Built-in Adaptor                            | Or ABC 54705-B-A-1                         |
| ABC 54705-B-C-2                             | 180-044M06-( )-( )S and 180-044M07-( )-( )P | Tempo F23K-106-03 FoPro                    |

# Testing: Light Loss Testing

- Select adapters and probes required for cables under test. This would be based on ferrule size, connector type and glass fiber size.
- Examine all mating surfaces and adapters.
  - Evaluate for cleanliness and damage.
  - Clean if required.
  - If there is unacceptable damage replace.
- Connect a Probe to the Stabilized Light Source (SLS) and one to the Optical Power Meter (OPM).
- Connect the Probes together with appropriate adapter.
- Power up equipment, select operating wavelength (850nm) and allow equipment to stabilize.
- Set Reference Level (zero meter).
- Disconnect Probes at adapter while keeping power on.

# Check Your Understanding

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Describe the process of light loss testing?

What adapters and probes are needed in this process?

# Light Loss testing

- Select and install the appropriate probe adaptors for the connectors under test.
- With power still on connect one of the probe adapters to one side of the cable to be tested.
- Connect the other probe adapter to the other end of the cable to be tested.
- Record the reading on the OPM.
- With probes still attached to SLS and OPM swap ends and re-measure.
- Record the reading on the OPM and average it with the other.
- This is the assigned light loss for this assembly.

# Light Loss Testing

- Repeat these steps for all channels to be used on the Cable under test (the CUT).
- The allowable loss for each fiber is .5 db.
- If any one reading is higher than the allowable budget
  - Re-inspect all ends and re test.
  - If you are still over budget reject this fiber.
    - Remove and replace fiber.



# Check Your Understanding

What is the *CUT* and how do you use it?

What is the allowable loss of each fiber?

Why is this significant?

# Exercise: Testing Practice

1. Determine the light loss budget for the cable on your routing board.
2. Clean all mating surfaces.
3. Perform a reference level set up.
4. Connect the connector adaptors and probes to the cables under test.
5. Read and record the insertion loss from the optical power meter's display.
6. Reverse the direction of the cable under test and repeat steps 3 and 4.
7. Average the readings and determine if the insertion loss is less than the allowable limit.
8. If not, clean and test again.
9. If the measured insertion loss is greater than the allowable limit after a second test, reject the cable.

# Congratulations

**After successfully testing the cable, you will be ready to test your knowledge.**

# Review

How much do you remember?

**By now, you should be able to:**

- Inspect the end face of fiber optic termini for acceptable levels of cleanliness and damage.
- Clean the end faces of fiber optic cables.
- Determine the allowable optical loss limit for multiple cable assemblies.
- Perform a light loss test to determine if fiber optic cables have acceptable levels of attenuation.

# Review Game

1. The instructor will divide the room into two teams.
2. The first team to X number of points wins the game.
3. Select a spokesperson.
4. Read the question.
5. Confer with your team. State an answer.
6. If you are correct, you get a point. If your answer is incorrect your team loses two points and the other team gets to try to answer for a point. If your team scored on that round it is now the other teams turn.
7. Each team takes turns attempting to earn points.

**Question:**

What is the purpose of a reference level set up?

**Answer:**

A reference level set up is used to set the reference to zero so you so when you attach a cable to be tested the reading is the loss. (attenuation)

**Question:**

What is the most important safety precaution when inspecting fiber optic connectors or termini end face?

**Answer:**

When inspecting a connector or terminus end face, disconnect the connectors from the equipment at both ends or perform a lock out on that circuit..

**Question:**

Complete this sentence: Causes of attenuation (light loss) include; end face contamination, kinks or breaks in the cable, stresses at optical interfaces, and ...

**Answer:**

Bending fiber optic cables tighter than the minimum bend radius.



**Question:**

What do you do if a fiber optic cable fails a light loss test two times.

**Answer:**

Clean the cable between tests, but reject a cable that fails a light loss test a second time.

**Question:**

Can a continuity test measure optical loss?

**Answer:**

No. An optical continuity test will only verify that some light is transmitted. It will not determine if the amount of light is within acceptable levels.

**Question:**

What must be done to the fiber optic probe prior to performing an optical loss test?

**Answer:**

Perform a visual inspection to ensure the cables meet inspection requirements. Then perform a reference level set.

**Question:**

How far can cracks extend into an end face and still be considered acceptable?

**Answer:**

A crack may extend  $\frac{1}{2}$  of the radius into the end face as long as the crack enters and exits. Any crack inside the core is rejectable.

**Question:**

What is the allowable light loss for a Fiber Optic Cable?

**Answer:**

The light loss can not exceed 0.5dB for each fiber in a cable. If a fiber does exceed it needs to be replaced prior to being used.

# Final Review

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Are there any final questions?

# Final Exam

- You have 1.5 hours to complete the exam.
- This is a closed book test.
- When done give your exam to the instructor.
- An 80% or better on the exam is required to pass the course.