

CLEARED
For Open Publication

Jan 27, 2026

Department of Defense
OFFICE OF PREPUBLICATION AND SECURITY REVIEW

KITCO

FIBER OPTICS



FIBER STANDARDS

AVIATION STANDARDS

Note: Refer to Section 3 for a more detailed description

- 1. Society for Automotive Engineers International (SAE):** An International Organization for standards development in the engineering of powered vehicles (Aircraft, boats, cars, and trucks).
- 2. Telecommunications Industry Association (TIA):** Leading trade organization accredited by the American National Standards Institute (ANSI) to develop voluntary, consensus-based industry standards for a wide variety of information & communications technology (ICT) products representing global industries through standards development, policy initiatives and worldwide environmental regulatory compliance.

AVIATION STANDARDS

- 3. Aircraft Radio Incorporated (ARINC):** Established in 1929, is a major provider of transport communications and systems engineering solutions for eight industries: aviation, airports, defense, government, healthcare, networks, security, and transportation.
- 4. Navair 01-1A-505-1 thru -14:** Aircraft electric and electronic wiring for military aircraft (Installation and repair practices). See NA 01-1A-505-4 for fiber optic wiring practices.
- 5. MIL-STD-1678-1:** Department of defense standard practice for fiber optic cabling systems requirements and measurements.

AVIATION STANDARDS

6. **The Aerospace and Defence Industries Association of Europe (ASD)**: ASD represents the aeronautics, space, defense and security industries in Europe in all matters of common interest with the objective of promoting and supporting the competitive development of the sector. They define European Norm (EN) standards.

7. **ACE/6-/10 Aerospace-fiber optic systems and equipment**: To prepare draft British Standards for aerospace avionic fiber-optic cables, connectors and systems as directed by ACE/6.

History of MIL-STD-1678

Purpose

Defines **test and measurement requirements** for **fiber-optic cabling systems** to ensure **standardization, reliability, interoperability, and maintainability** across U.S. Department of Defense platforms.

Origins (Late 1970s)

- Initially issued as **DOD-STD-1678**
- Addressed early military adoption of **fiber-optic communications**
- Established baseline **optical test and measurement practices** during a copper-dominant era

Transition to MIL-STD

- Re-designated as **MIL-STD-1678** under DoD standards modernization
- Improved **clarity, consistency, and lifecycle management**
- Enabled uniform application across **joint service fiber-optic systems**

Multi-Part Structure (2010)

Beginning around May 28, 2010, MIL-STD-1678 was reorganized into a multi-part standard. Instead of a single document, the standard was divided into six coordinated parts, each addressing a specific aspect of fiber optic cabling systems. This modular approach allowed individual sections to be updated as technology evolved without rewriting the entire standard.

Six-Part Organization

Part 1: General design, installation, and maintenance requirements

Part 2: Optical performance measurements

Part 3: Physical, mechanical, environmental, and material measurements

Part 4: Test sample configuration and fabrication requirements

Part 5: Design-phase and legacy system measurements

Part 6: Parts commonality and support equipment standardization

MIL-STD-1678 — Modern Revisions & Current Importance

Recent Updates (2022–2025)

- Multiple **revisions and change notices** issued across several parts
- Reflect **advances in fiber-optic technology** and **improved test methods**
- Updated to meet **evolving military operational requirements**
- **Defense Logistics Agency (DLA)** maintains the official versions of each part

Purpose & Importance

- Standardizes **design, testing, installation, and maintenance** of military fiber systems
- Ensures **high reliability** in harsh operational environments
- Supports **long-term sustainment** and lifecycle management
- Enables **interoperability** across services and platforms

Current Relevance

A cornerstone reference for **engineers, technicians, instructors, and contractors** supporting military fiber-optic systems.

MIL-STD-1678-1D
w/ Change Notice 2

REQUIREMENT 1306

6.3.1 Aircraft applications. Commercial entities include Government or Contracted Installation/Repair/Training Teams and those contracted within Government organizations such as Fleet Readiness Centers (FRCs) Depot level Maintenance and Repair, Marine Aviation Logistics Squadrons (MALs), Air Force Materiel Commands (AFMCs), Air Force Air Logistics Centers (ALCs), Aircraft Sustainment Wings (ASWs), Combat Sustainment Wings (CSWs), United States Army Aviation and Missile Command (AMCOM), military training centers, and the Aviation and Missile Research, Development, and Engineering Center (AvMC).

6.3.2 Navy shipboard applications. Commercial entities include Ship Builders, Industrial Activities, Government/Contracted Installation/Repair Teams, Alteration Installation Teams (AITs), Ship/Planning Yards, On-Site Representative (OSRs) in addition to those contracted within Government organizations such as Supervisor of Shipbuilding (SUPSHIP), Regional Maintenance Centers (RMCs), Field Maintenance Activities (FMAs), and In Service Engineering Agents (ISEAs)."

TABLE 1306-IV. Number of skill sets required selection guide for maintainers.

Function Performed	Minimum Essential Skill Sets
Those working in the locations with fiber optic cabling (i.e., handling)	Awareness
Those disconnecting the fiber optic cabling	Awareness, Basic skill sets
Those performing troubleshooting of fiber optic cabling	Awareness, Basic skill sets, Intermediate skill sets
Those repairing of fiber optic cabling	Awareness, Basic skill sets, Intermediate skill sets, Advance skill sets
Those fabricating new fiber optic cabling	Awareness, Basic skill sets, Intermediate skill sets, Advance skill sets, Craftsman skill sets

TABLE 1306-I. General/cable harness personnel proficiency skill sets.

Actions	Maintainer		Cable harness assembler		Installer		Non-fiber optic user		Quality assurance	
	Initial	Recur	Initial	Recur	Initial	Recur	Initial	Recur	Initial	Recur
Awareness										
Basic theory	X		X		X		X		X	
Laser and fiber safety	X	X	X	X	X	X	X	X	X	X
Handling	X		X		X		X		X	
Labeling	X		X		X		X		X	
Requirement for ferrule end face cleanliness	X		X		X		X		X	
Criteria for ferrule end face inspection and geometry	X		X		X		X		X	
Basic skill sets										
Clean ferrule end face	X		X		X				X	
Inspect ferrule end face	X		X		X				X	
Perform optical loss test on cable assembly/harness	X		X		X				X	
Intermediate skill sets										
Troubleshoot connector and cabling	X		X		X				X	
Install cable harness	X		X		X				X	
Use OTDR to test cable harness	X	X	X	X	X				X	
Theory of operation	X	X	X	X	X				X	
Advance skill sets										
Perform connector/terminus terminations	X	X	X	X	X	X				
Perform repairs (mechanical splicing)	X	X	X	X						
Perform repairs (fusion splicing)	X	X	X	X						
Perform remove and replace of installed cabling	X		X		X					
Craftsman skill sets										
Perform cable harness assembly	X	X	X	X						
Perform post installation inspection	X				X				X	X

CONNECTOR QUALITY



ENDFACE QUALITY

- Criterias defined in ARINC Report 805 standard
- Connector end-face is divided into multiple zones
 - Size will depend on connector type
- Tolerances will differ for each zones
 - Number of defects
 - Number of scratches
 - Size of defects and scratches
- Slight indents and/or score marks **"ALWAYS"** acceptable (adhesive zone)

ARINC 805 measurement regions for single fiber connectors

Zones	Single-mode	Multimode
A: Core	0 - 25µm	0 - 65µm
B: Cladding	25 - 120µm	65- 120µm
C: Adhesive	120 -135µm	120 - 135µm
D:Contact	135 - 250µm	135 - 250µm

ENDFACE QUALITY

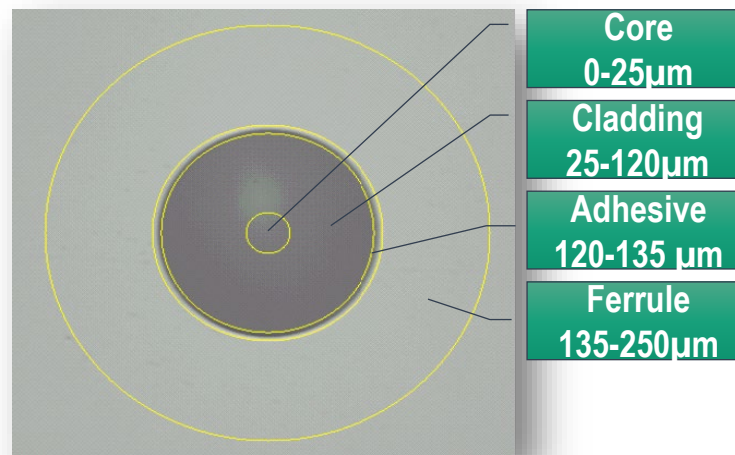
Definitions of Defects and Contamination

Defect Type	Defect or Contamination Definition
Chips	Damage to the end face surface or indentations where the native material is missing.
Cracks	A structural irregular defect that penetrates into the fiber.
Pits	Any circular surface defects or indentations that generally have a round appearance.
Scratches	Any linear surface defect that typically transverses the core and/or cladding. Scratches can be light or dark in appearance.
Debris	Material that can be removed with cleaning processes found in ARINC Report 805.
Contamination	Material that cannot be removed with cleaning processes found in ARINC Report 805.
Film/Oil	Material that can be removed with cleaning processes found in ARINC Report 805.

ENDFACE QUALITY

Beginning of Life Visual Inspection Criteria for Single-mode Optical Fiber (400X)

Visual Inspection Criteria	Zone A Core Area	Zone B Cladding Area	Zone C Adhesive Bond Area	Zone D Ferrule Area
Cracks	None	None	No Limit on Size or Number	None
Chips/Pits/Contamination	None >1 μm	Maximum of 2 at $\leq 5 \mu\text{m}$	No Limit on Size or Number	None >10 μm
Scratches	None > 1 μm in Width No Limit on Number of Scratches	None > 3 μm in Width No Limit on Number of Scratches	No Limit on Size or Number	No Limit on Size or Number
Debris	None	None	Maximum of 5 Pieces of Debris $\leq 10 \mu\text{m}$ in Diameter	Maximum of 5 Pieces of Debris $\leq 10 \mu\text{m}$ in Diameter
Film/Oil	None	None	None	None

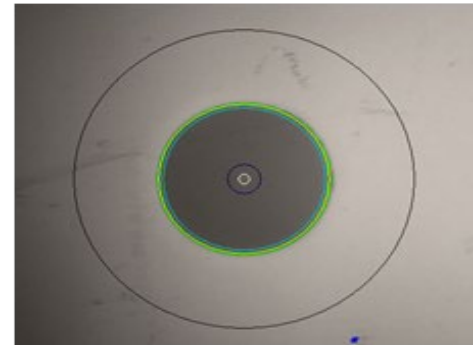
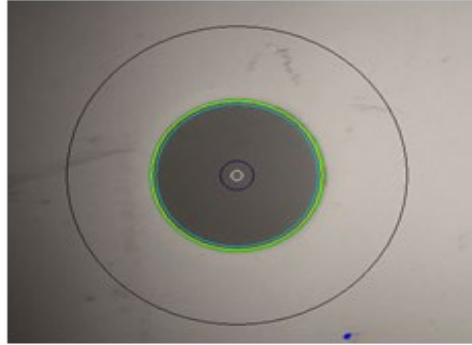


- Core
0-25 μm
- Cladding
25-120 μm
- Adhesive
120-135 μm
- Ferrule
135-250 μm

ENDFACE QUALITY

Beginning of Life

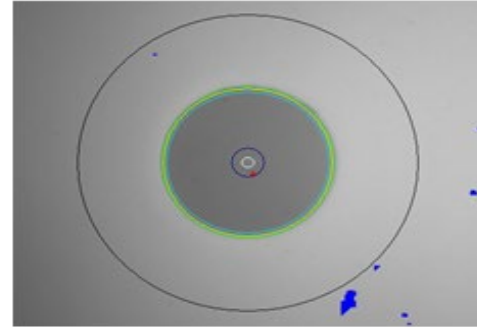
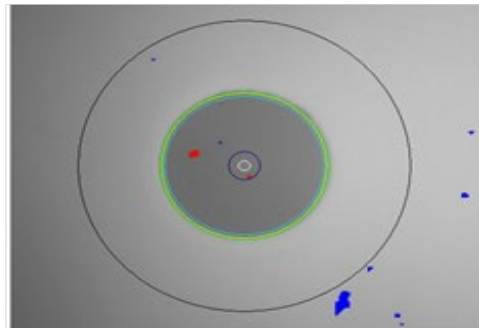
PERMITTED



Zone A: PASS
Zone B: PASS
Zone C: PASS
Zone D: PASS

Comments: Larger contamination outside of Zone D is permitted.
Blue color highlighted debris is acceptable.

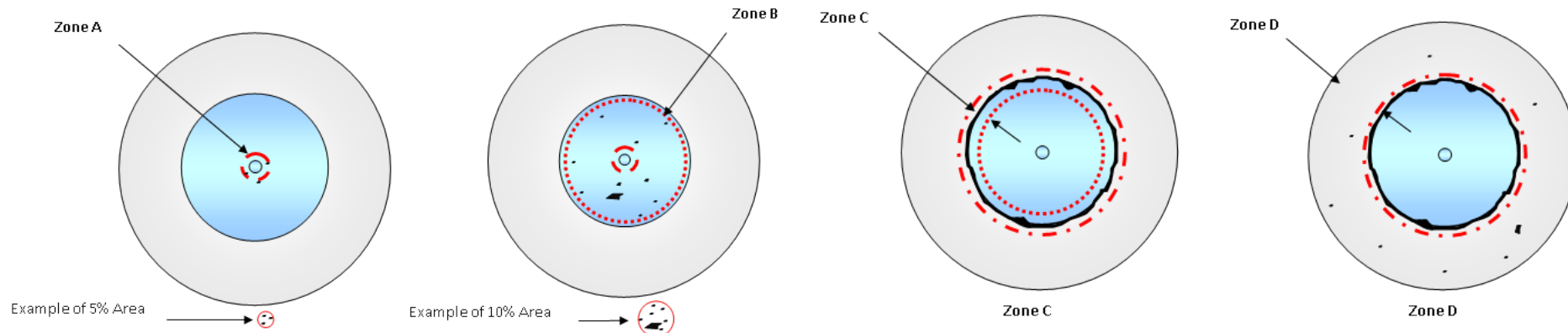
NOT PERMITTED



Zone A: **FAIL Contamination (Red Circle) is larger than 1µm (actual size is 1.5 µm)**
Zone B: PASS
Zone C: PASS
Zone D: PASS
Comments: Debris/Defects/Contamination shown in red is Not Acceptable.

ENDFACE QUALITY

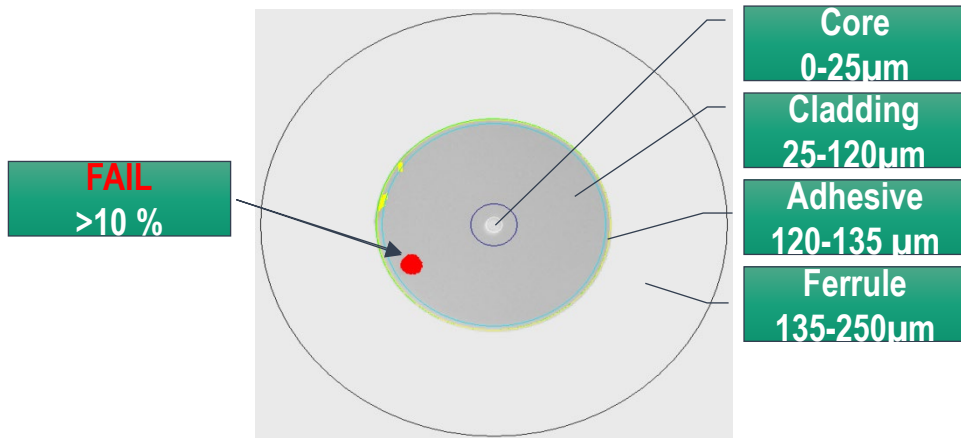
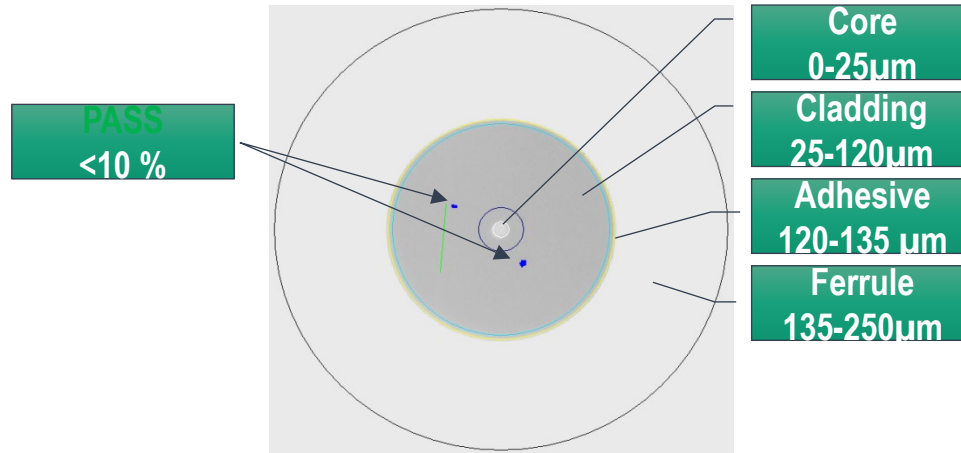
In-Service Visual Inspection Criteria for Single-mode Optical Fiber (400X)				
Visual Inspection Criteria	Zone A Core Area	Zone B Cladding Area	Zone C Adhesive Bond Area	Zone D Ferrule Area
Cracks	None	None	No Limit on Size or Number	None
Chips/Pits/Contamination	Not to exceed 5 percent of total area	Not to exceed 10 percent of total area	No Limit on Size or Number	No Limit on Size or Number
Scratches	No more than 3 $\geq 3 \mu\text{m}$ in Width, any Length	No more than 6 μm in Width, no limit on number	No Limit on Size or Number	No Limit on Size or Number
Debris	None $> 3 \mu\text{m}$	None $> 3 \mu\text{m}$	Maximum of 5 Pieces of Debris $\leq 10 \mu\text{m}$ in Diameter	Maximum of 5 Pieces of Debris $\leq 10 \mu\text{m}$ in Diameter
Film/Oil	None	None	None	None



Visual Example of Allowable Pits/Chips/Contamination and percentage area

ENDFACE QUALITY

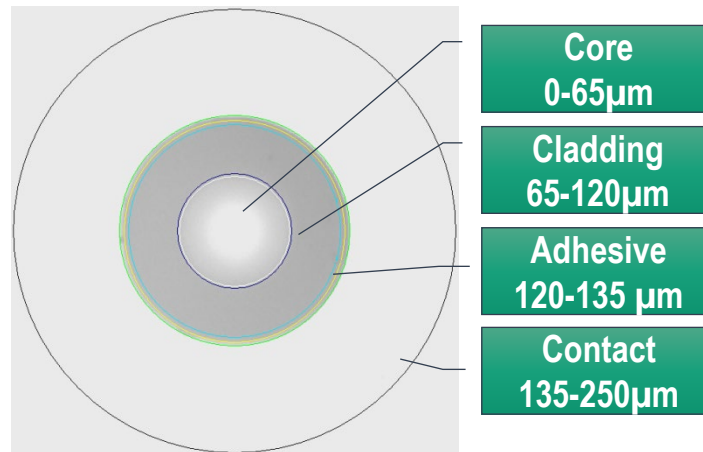
In-Service single-mode visual inspection criteria



ENDFACE QUALITY

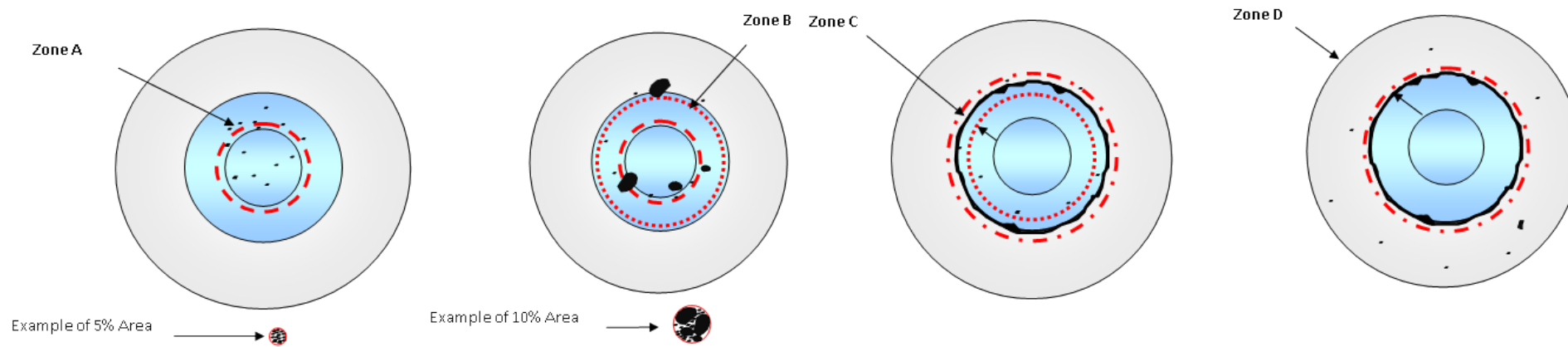
Beginning of Life Visual Inspection Criteria for Multimode Optical Fiber (200X)

Visual Inspection Criteria	Zone A Core Area	Zone B Cladding Area	Zone C Adhesive Bond Area	Zone D Ferrule Area
Cracks	None	None	No Limit on Size or Number	None
Chips/Pits/Contamination	None > 1 μm	Maximum of 2 at $\leq 5 \mu\text{m}$	No Limit on Size or Number	None > 10 μm
Scratches	None > 1 μm in Width No Limit on Number of Scratches	None > 3 μm in Width No Limit on Number of Scratches	No Limit on Size or Number	No Limit of Size or Number
Debris	None > 1 μm	Maximum of 2 Pieces of Debris at $\leq 5 \mu\text{m}$	Maximum of 5 Pieces of Debris $\leq 10 \mu\text{m}$ in Diameter	Maximum of 5 Pieces of Debris $\leq 10 \mu\text{m}$ in Diameter
Film/Oil	None	None	None	None



ENDFACE QUALITY

In-Service Visual Inspection Criteria for Multimode Optical Fiber (200X)				
Visual Inspection Criteria	Zone A Core Area	Zone B Cladding Area	Zone C Adhesive Bond Area	Zone D Ferrule Area
Cracks	None	None	No Limit on Size or Number	None
Chips/Pits/Contamination	Not to exceed 5 percent of total area	Not to exceed 10 percent of total area	No Limit on Size or Number	No Limit on Size or Number
Scratches	No more than 3 $\geq 3 \mu\text{m}$ in Width, any Length	No more than 6 μm in Width, no limit on number	No Limit on Size or Number	No Limit on Size or Number
Debris	None $> 3 \mu\text{m}$	None $> 3 \mu\text{m}$	Maximum of 5 Pieces of Debris $\leq 10 \mu\text{m}$ in Diameter	Maximum of 5 Pieces of Debris $\leq 10 \mu\text{m}$ in Diameter
Film/Oil	None	None	None	None

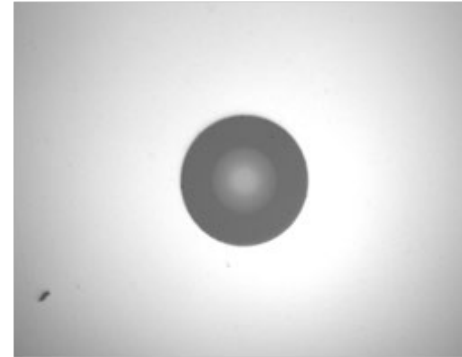
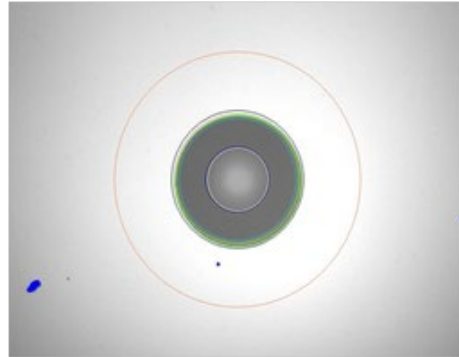


Visual Example of Allowable Pits/Chips/Contamination and percentage area

ENDFACE QUALITY

Beginning of Life

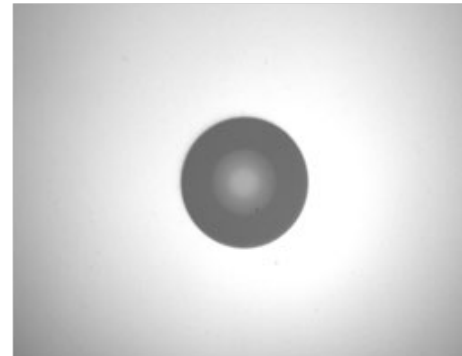
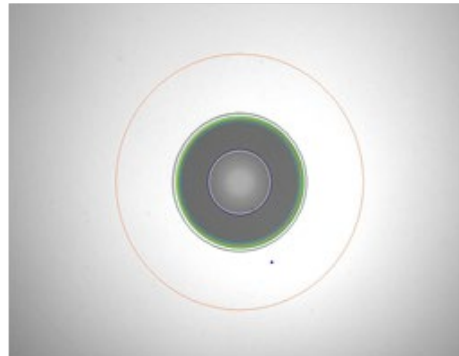
PERMITTED



Zone A: PASS
Zone B: PASS
Zone C: PASS
Zone D: PASS

Comments: Larger contamination outside of Zone D is permitted.
Blue color highlighted debris is acceptable.

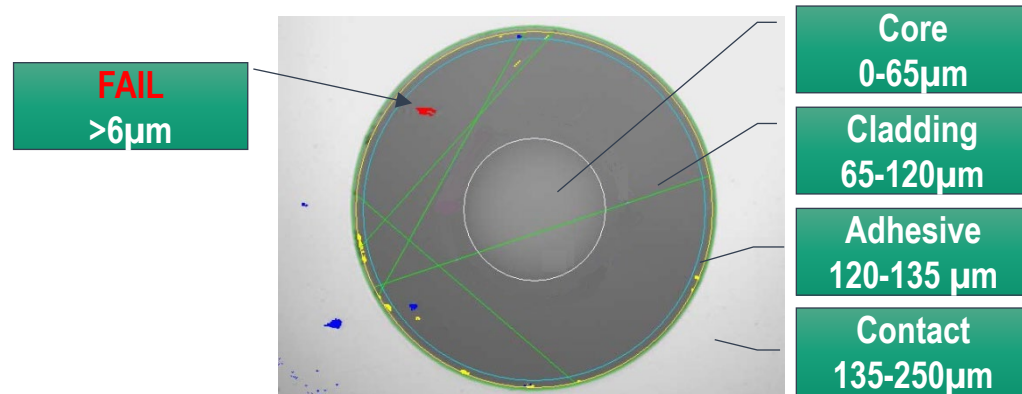
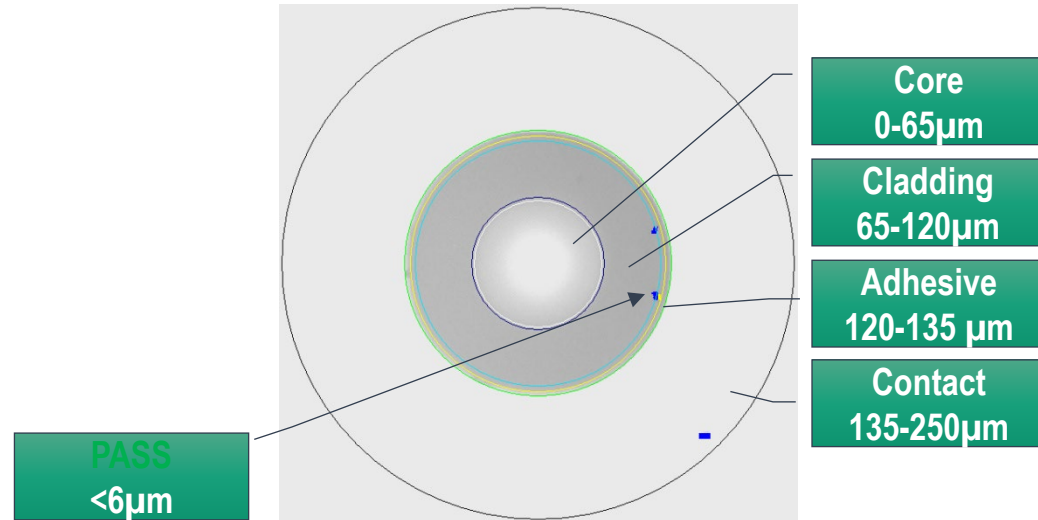
NOT PERMITTED



Zone A: **FAIL Contamination (Red Circle) is larger than 1µm (actual size is 1.5 µm)**
Zone B: PASS
Zone C: PASS
Zone D: PASS
Comments: Debris/Defects/Contamination shown in red is Not Acceptable.

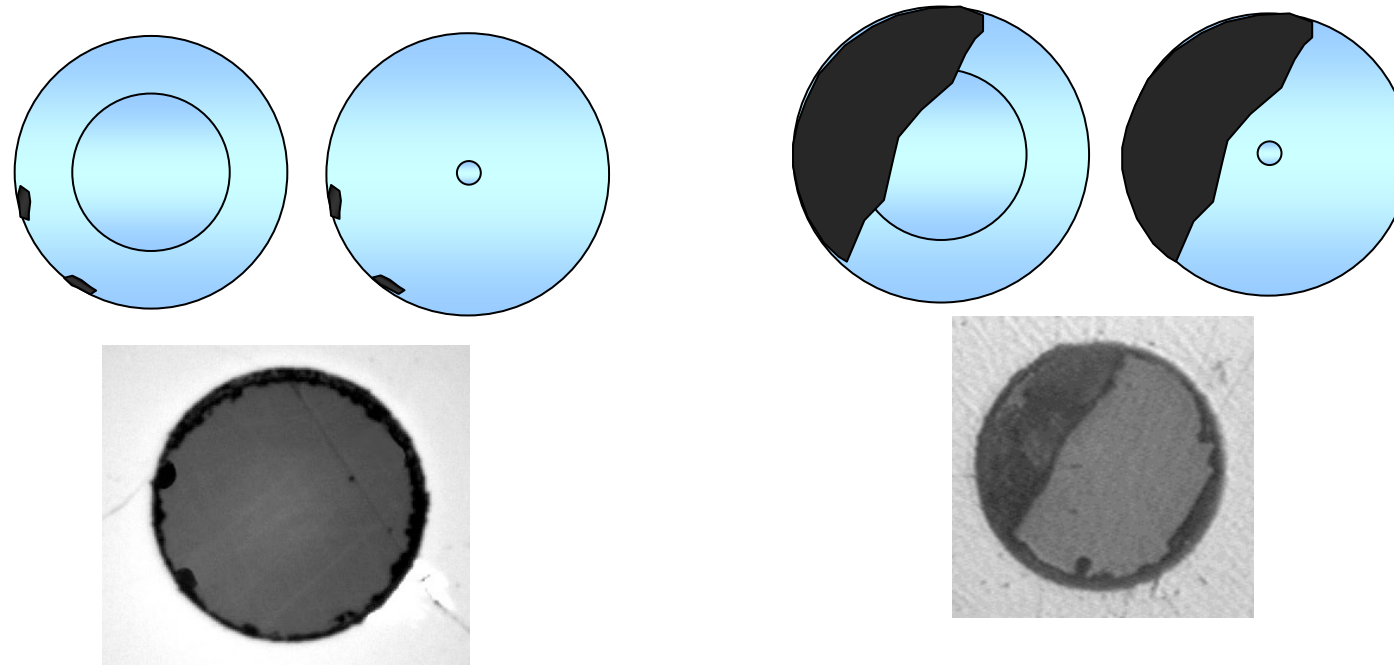
ENDFACE QUALITY

In-Service multimode visual inspection criteria



ENDFACE QUALITY

Defects and Contamination (CHIPS)

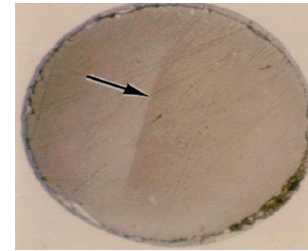
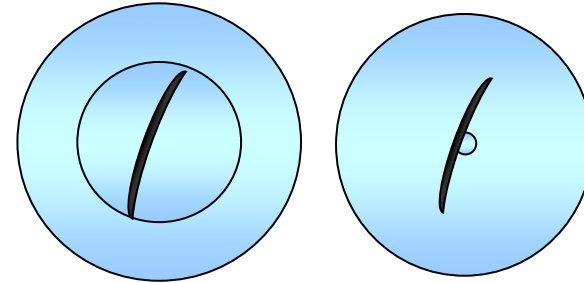
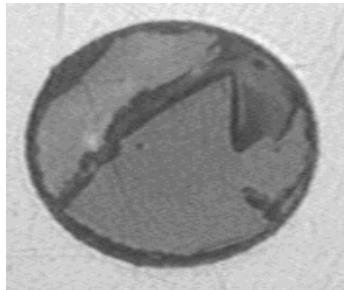
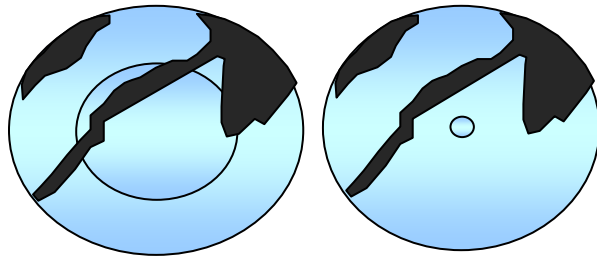


PERMITTED

NOT PERMITTED

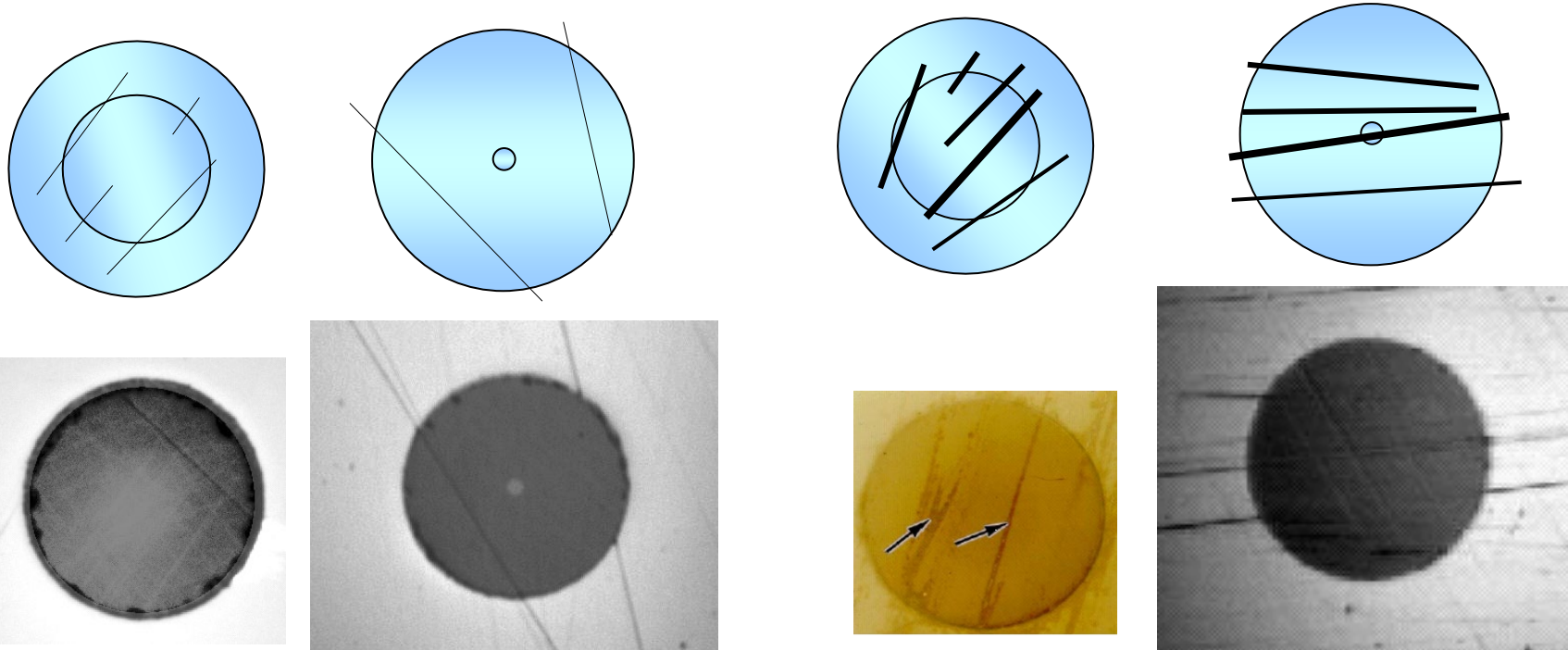
ENDFACE QUALITY

Defects and Contamination (CRACKS)



ENDFACE QUALITY

Defects and Contamination (SCRATCHES)

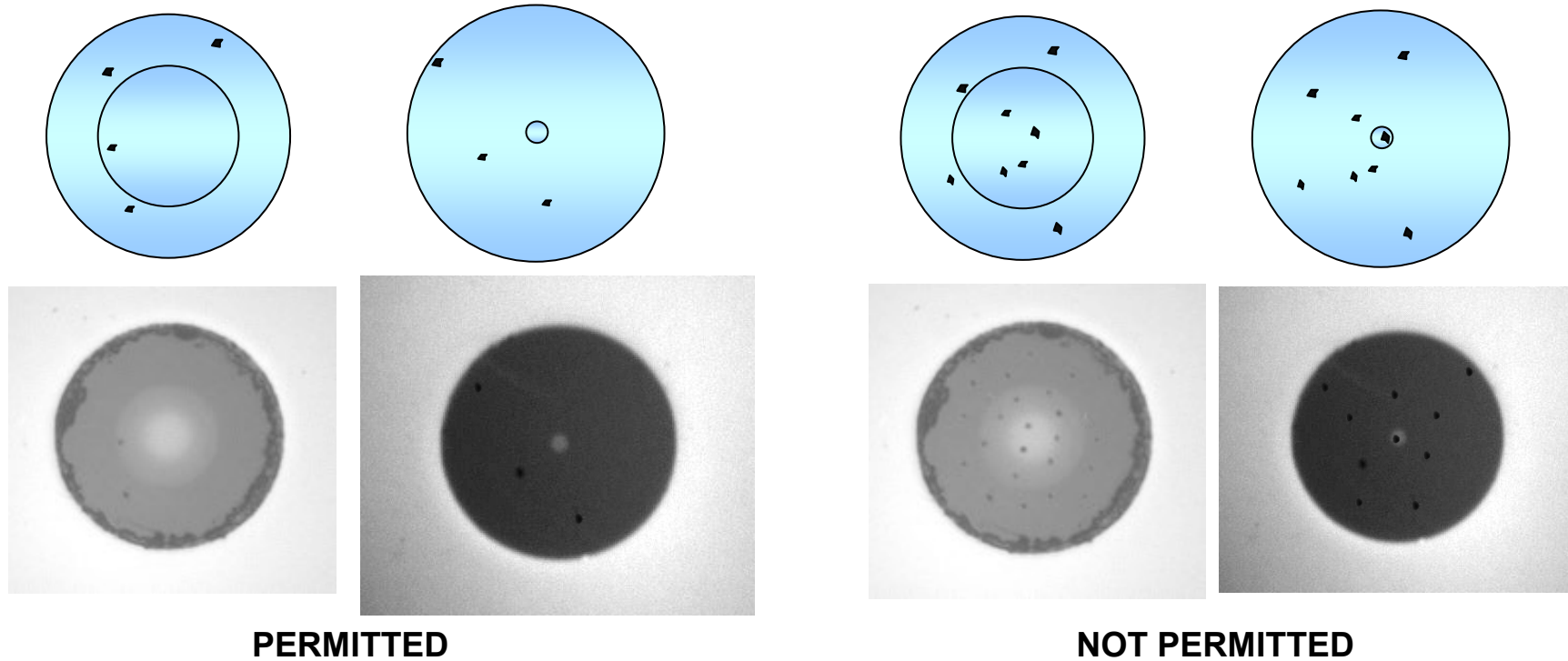


PERMITTED

NOT PERMITTED

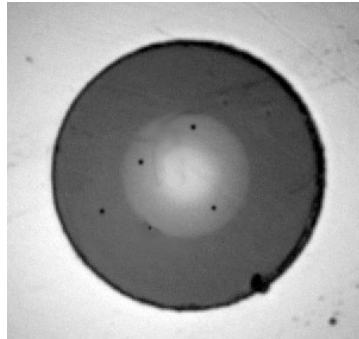
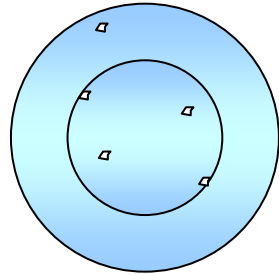
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Defects and Contamination (PITS)

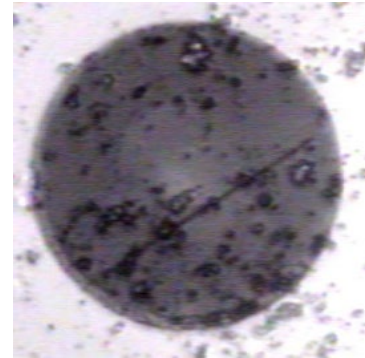
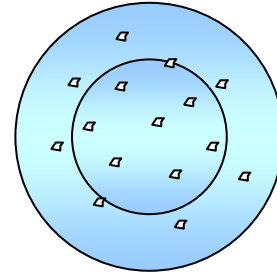


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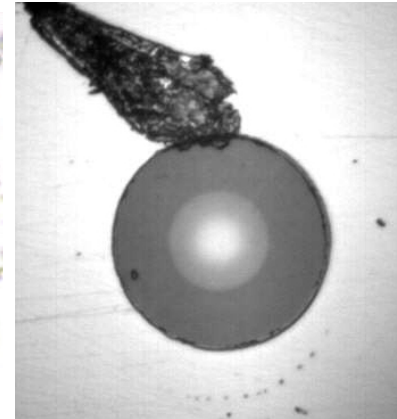
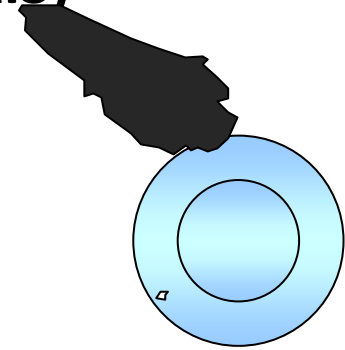
Defects and Contamination (DEBRIS)



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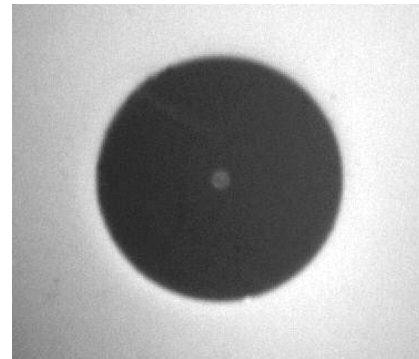
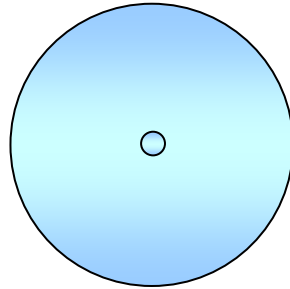
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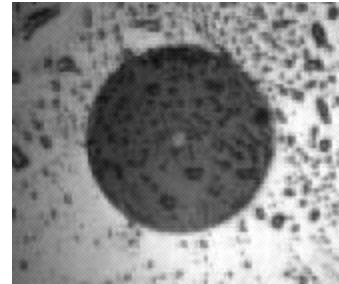
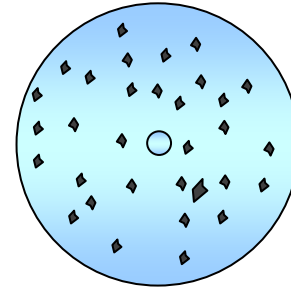
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Defects and Contamination (DEBRIS)

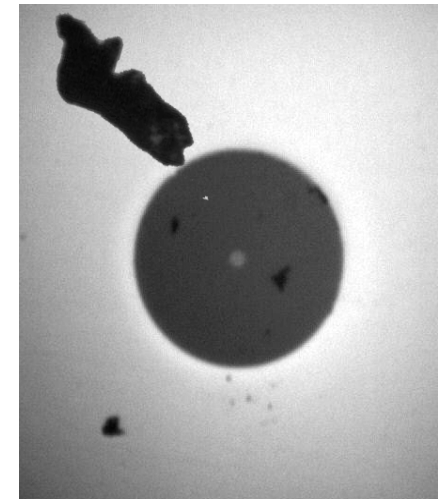
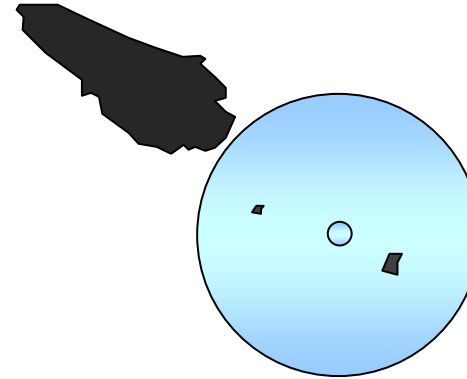
Five or fewer
Discernable
Debris



PERMITTED

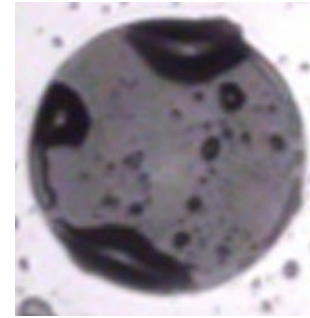
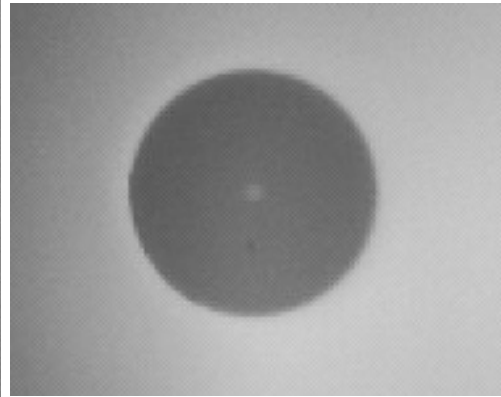
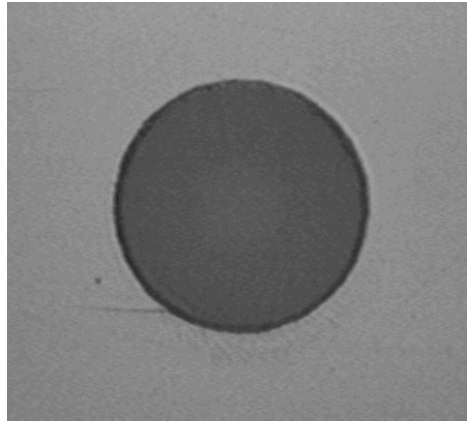
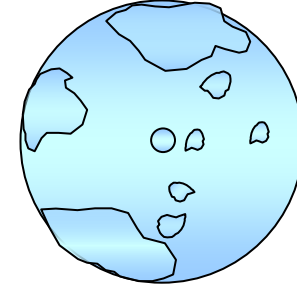
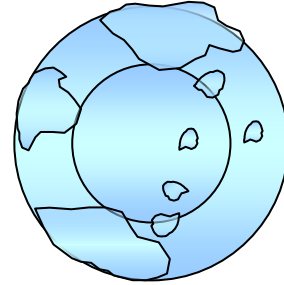
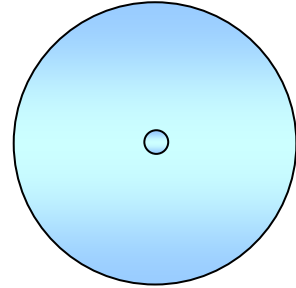
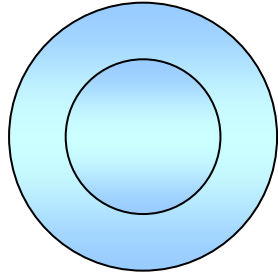


NOT PERMITTED



ENDFACE QUALITY

Defects and Contamination (FILM/OIL)



PERMITTED

NOT PERMITTED

FERRULE END FACE VISUAL INSPECTION

INSTALLATION AND REPAIR PRACTICES AIRCRAFT FIBER OPTIC CABLING

Reference Material

None

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Record of Applicable Technical Directives

None

Support Equipment Required

Item No.	Description	Qty	Cage Code	Part Number
Common Support Equipment (CSE)				
6202AA	Set of fiber optic inspection equipment, accessories, and Visual Fault Locator (VFL). <u>17/</u>	1	30003	4007AS100-2
6202BA	Video Display <u>1/</u>	1	1QLU8	FBP-HD4i-NAVY
6202CA	FOVIS Probe <u>1/</u>	1	1QLU8	FBP-P5000i-NAVY
6202DA	Barrel Adapter <u>2/</u>	1	1QLU8	FBPP-BAP1
6202DB	Probe tip, M29504/4 pin terminus <u>8/</u>	1	1QLU8	FBPT-MIL-2P
6202DC	Probe tip, M29504/5 socket terminus <u>9/</u>	1	1QLU8	FBPT-MIL-2S
6202DD	Probe tip for M29054/4/5 60° angle <u>3/</u> , <u>4/</u> , <u>7/</u> , <u>10/</u>	1	1QLU8	FBPT-MIL2-A8
6202DE	Probe tip for 1.25 mm dia. Ferrule <u>11/</u>	1	1QLU8	FBPT-U12M

For more
information,
please see
Brice Wilson
Booth 632

[brice.wilson@
kitcofo.com](mailto:brice.wilson@kitcofo.com)

757-679-4071.

