

# Aerospace Fiber Optics

AFO 101, Session 4

## ***Fiber Optic Inspection and Evaluation***

# Session Objectives

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

- Work safely with materials used for examining and cleaning fiber optic assemblies.
- Properly handle fiber optic material to protect the cables from damage during the examining and cleaning process.
- Inspect and properly evaluate fiber optic termini for cleanliness and damage.

# Session Agenda

- Safety
- Material Handling
- Continuity testing
- Inspection and Evaluation
  - Cleanliness
  - Damage
- Inspection Review

# Inspection and Testing Terms

## Term

## Definition

**Light Source**

Light Meter

CleanBlast

Inspection  
Scope

PC Polish

Mandrel

FOP

### Light Source:

An inexpensive, practical instruments designed for performing insertion loss measurements on fiber optic links when used with an optical power meter.



# Inspection and Testing Terms

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## Definition

### Light Meter:

Used with the light source to measure optical power.



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**CleanBlast:** A portable fiber optic cleaning systems that utilize a highly filtered stream of pressurized gas in conjunction with a vacuum circuit to create a high flow rate jet across the surface of the fiber.



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### Inspection Scope:

A device used to inspect fiber optic connectors for scratches, dirt or other problems normally associated with poor transmission performance.



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### **PC Polish:**

Physical Contact Polish refers to the shape that the end face has after it is polished. Uses a domed PC polish with a radius on top.





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### **Mandrel (HOMP-MWF):**

High Order Mode Power Mandrel Wrap Filter is a mandrel about which the fiber is wrapped. It is part of a light loss test kit.



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### Fiber Optic Probe:

Is a test cable assembly used with a Glenair connector adaptor.



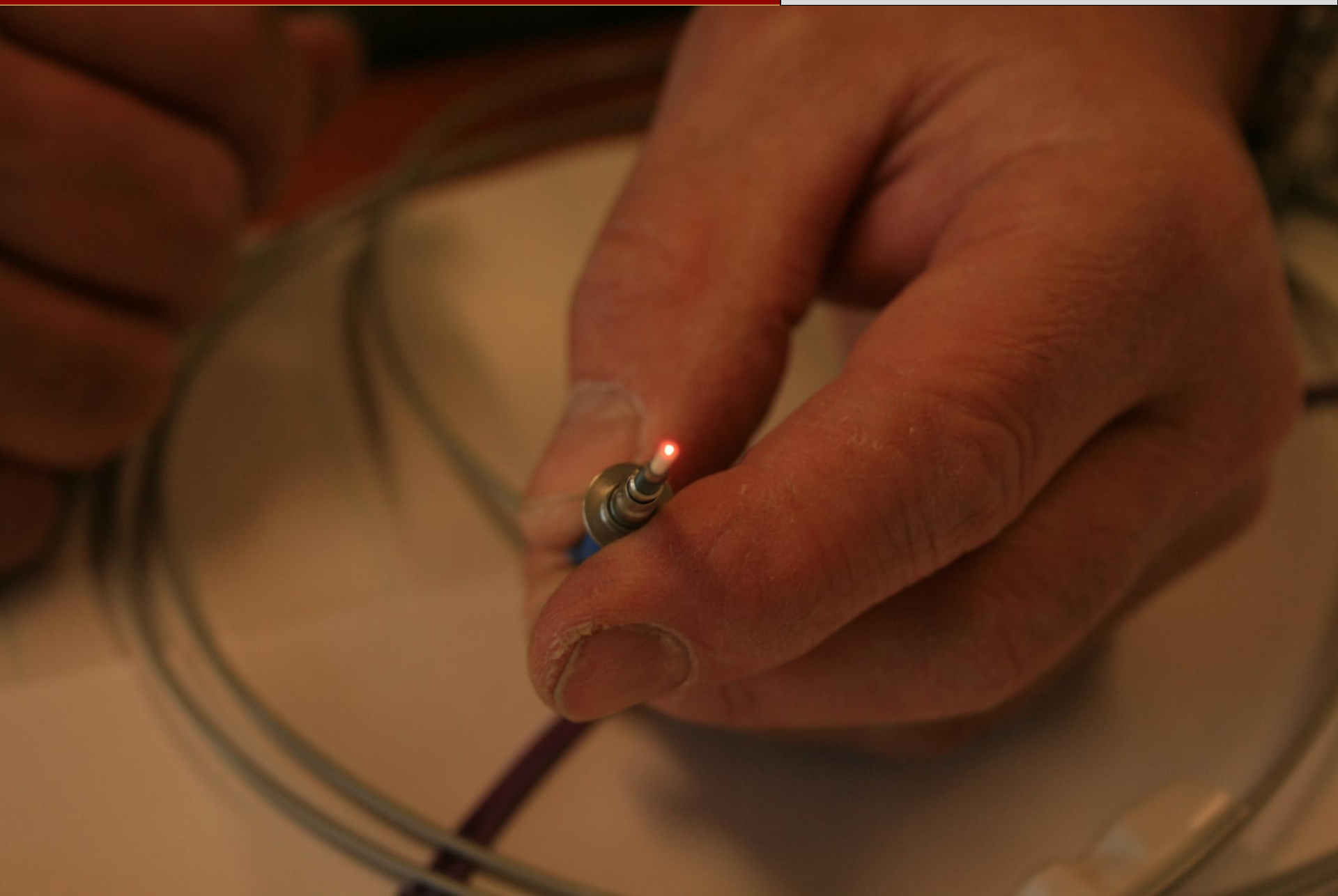
# Personal Safety

- Fiber optic cable can cause skin punctures and may separate below the skin following puncture.
- If a fiber optic cable gets cut, the fiber may piston out the end of the cable and cause a hazard.
- If this happens get two pieces of tape and install the tape as flags over the cut ends to capture the fiber.
- Wear safety glasses and protective gloves at all times when handling broken orunjacketed fibers.



# Personal Safety

- The light from functioning optical fibers resides in the non-visible infrared spectrum. This is below our perceivable visual range.
- If you look at a fiber that is transmitting it will burn the retina of your eye and cause permanent damage to your eye.
- Before examining the connector or the terminal end-face, disconnect the connectors from the equipment at both ends or set the equipment to off. (Lock out – Tag out)



# Check Your Understanding

What are some of the personal safety risks of fiber optic cable?

What are some precautions that you can take?

# Material Handling: Ensure Cleanliness

Exposure to airborne contaminants can cause attenuation. Protect fiber optic cables as follows:

- Clean your hands or use powder free gloves before you handle exposed fiber optics.
- Only disconnect connectors or remove the dust caps when you are ready to perform the procedures.
- If a connector has an alignment sleeve, inspect it. Clean if necessary.
- Inspect the end-face of all mating surfaces prior to re mating.

**DO NOT** touch the end face with your hands or anything else.



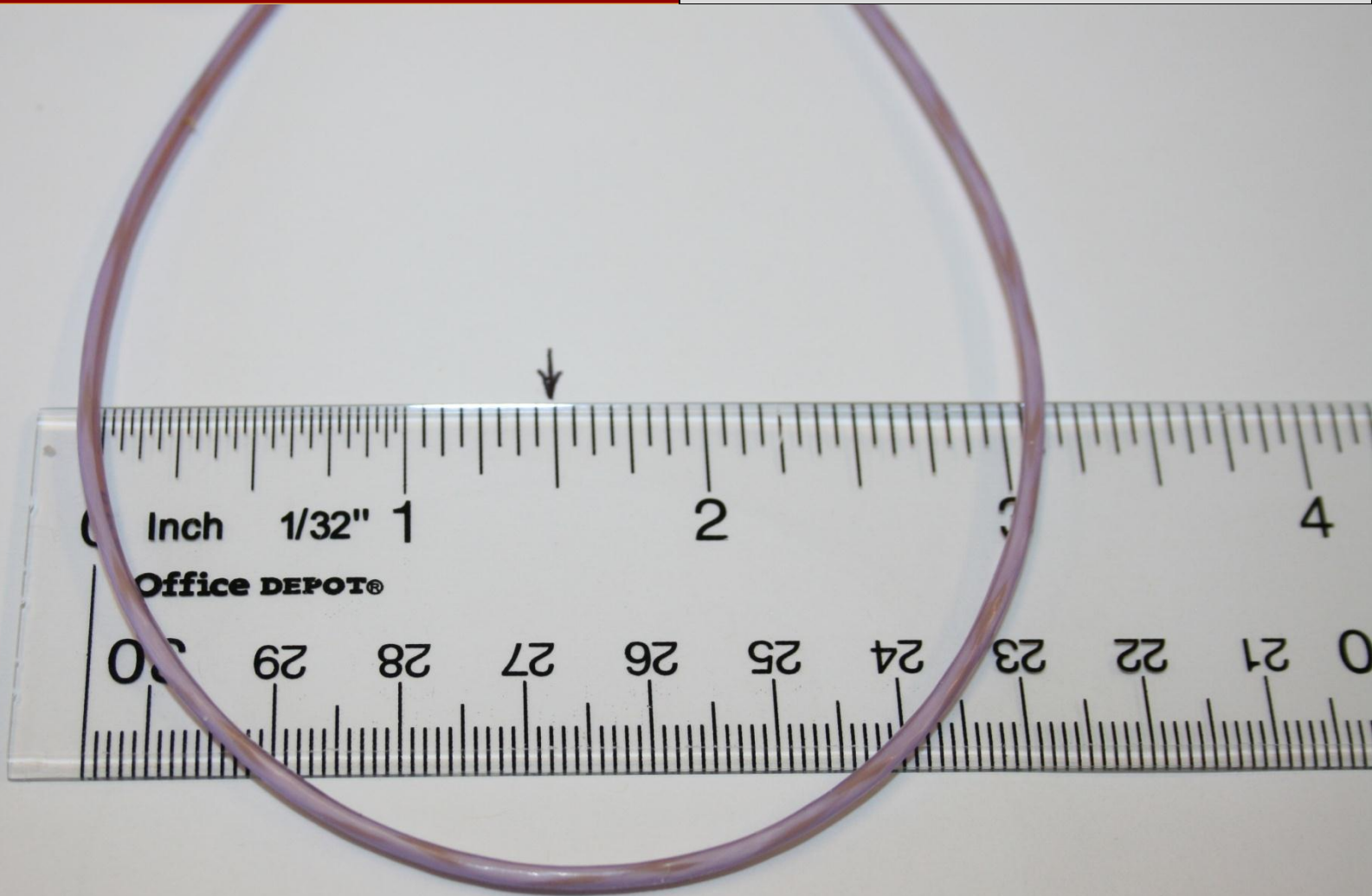
# Material Handling: Protect Cables

Handle fiber optic cable assemblies carefully:

- **DON'T** step on fiber optic cable assemblies or allow anything to fall on them.
- **DON'T** put anything on a fiber optic cable assembly.
- **DON'T** allow the connectors to fall on a hard surface.
- **DON'T** hang equipment from a fiber optic bundles.
- **DON'T** use fiber optic bundles as a hand hold.
- **DON'T** stress a fiber in any way.

# Material Handling: Bend Radius

**DON'T** bend a fiber optic cable or bundle to a bend radius than 1.5 inch.



# Check Your Understanding

What are the risks of exposure to airborne contaminants?

What are some of the important principles in material handling of fiber optic cables?

# Continuity Test

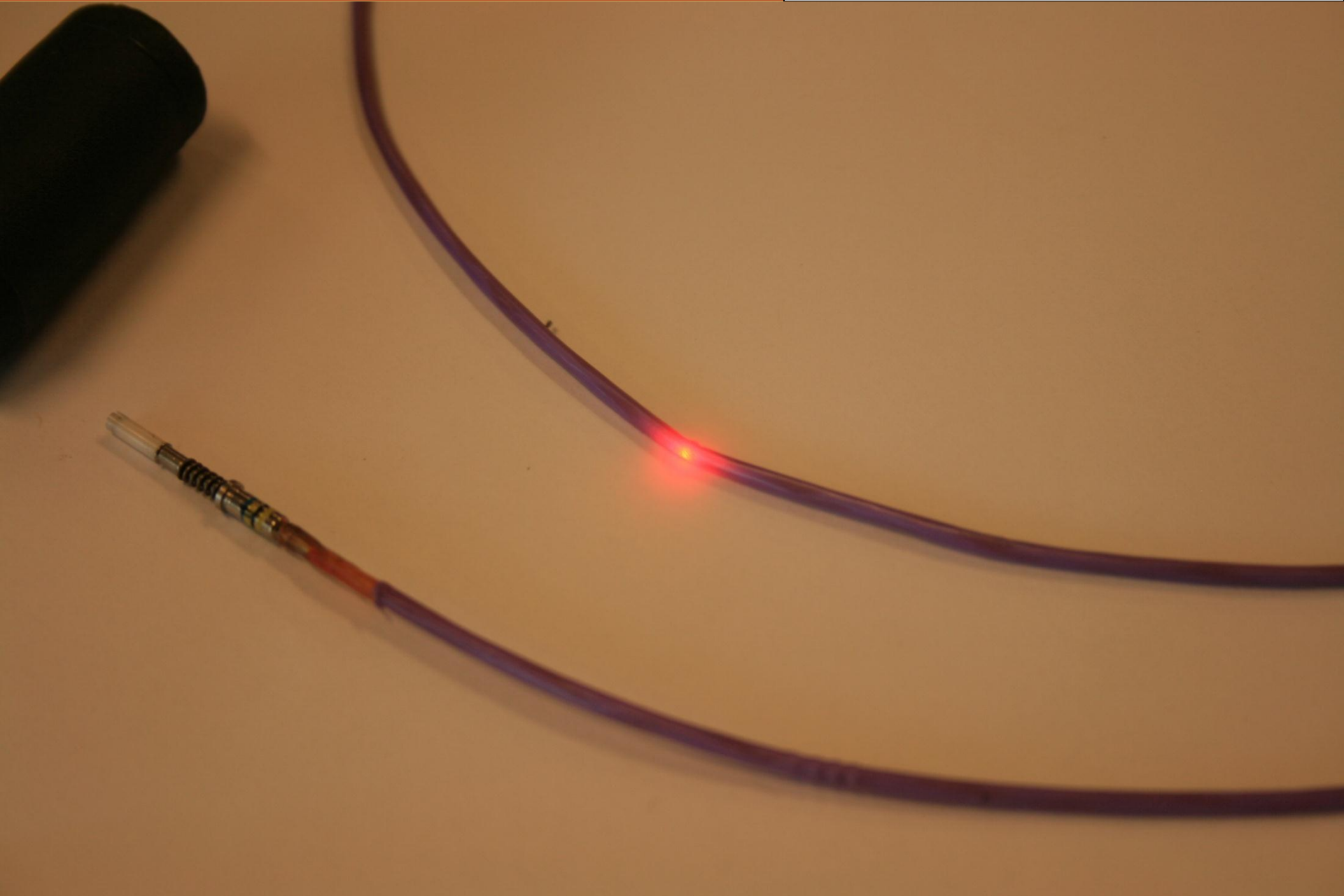
- Illuminate the end face of a fiber optic connector with a flashlight.
- If light does not shine out of the other end you will have to do further testing.
- Continuity testing provides an initial visual indication that a fiber will transmit light. It will not measure the attenuation of the fiber optic assembly.



# Continuity Test: Visual Fault Locator

1. A visual fault locator (VFL) is a source that fires a 680 nanometer red light through the fiber.
2. If the fiber is broken, the jacket will glow red.







# Inspection: End Face Examination

1. Select the appropriate adapters from Table.
2. Using a video scope and probe from the inspection kit, examine the termini end face at a 200X magnification.
3. Examine the end face for particles, contamination, scratches, cracks, and pits.
4. If the end face is clean, immediately install the connector or put on a clean dust cap or tape on a clean plastic bag.
5. If the end face is dirty, clean it.
6. If the end face has unacceptable cracks, scratches and/or pits, reject the fiber optic cable assembly.

# End Face Examination

## With the Westover CleanBlast system

1. Select the appropriate barrel assembly (lens) from the Table.
2. Attach the barrel assembly to the probe microscope (video scope).
3. Select the appropriate adapter from the Table for the connector / terminus.
4. Insert the probe into the mating adapter.
5. Select 200X and focus the image to inspect the end face.
6. If the end face is clean, move to the next terminus, immediately mate the connector or install dust cap.
7. If the end face is dirty use one of the cleaning processes identified in the next session.









 westover

# Inspection

Connector		Adapter Part Number	Disply	Scope	Barrel Assembly
Shell Type	Insert / Size				
		FBPT-A801-2-001-P	HD1-1	FBP-P5 (200X - 400X)	FBPP-BAP3 (Narrow Body)
		FBPT-A801-2-002-P			
		FBPT-A801-2-001-P			
		FBPT-A801-2-002-P			
		FBPT-A801-2-002-R			
		FBPT-A801-2-001-R			
		FBPT-A801-2-002-R			
		FBPT-A801-2-001-R			
	15-06	FBPT-A801-1-002-R			
	15-06	FBPT-A801-1-002-P			
	13-04	FBPT-A801-1-001-P			
	13-04	FBPT-A801-1-001-R			
D38999	Pin	FBPP-MILP			
	Socket	FBPP-MILS			
SC		FBPP-U25M			FBPP-BAP3 (Wide Body)
ST					
LC			FBPP-12M		

# Inspection

Use this inspection scope to inspect the end face of the termini as follows:

- Make sure that the adaptor is the correct size for the fiber and connector.
- Insert the ferrule end of the terminus onto the adaptor.
- Insert the barrel end of the fiber scope into the other end of the adaptor.
- Activate the internal light and examine the end face with a magnification setting of 200 x.
- Adjust the focus as needed.
- Look for cleanliness and signs of damage.



# Inspection: Termini Examination

- Film contamination is not permitted in the mating area.

**Acceptable**



**Not Acceptable**



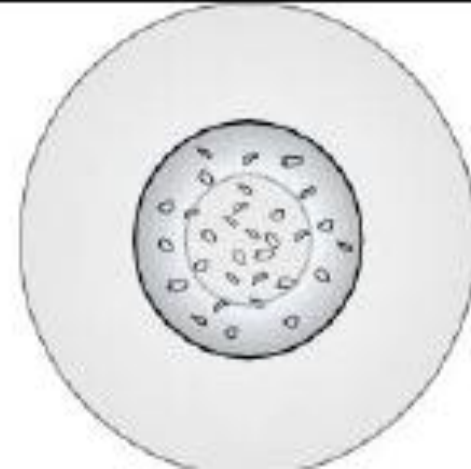
# Inspection: Termini Examination

- Particles are not permitted in the mating area

**Acceptable**



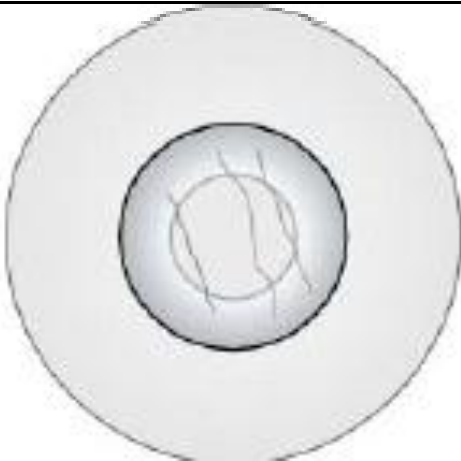
**Not Acceptable**



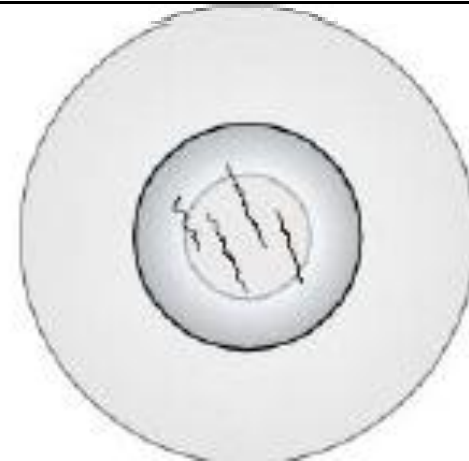
# Inspection: Termini Examination

- Light scratches are permitted as long as they are not numerous or in multiple directions.
- Wide or deep scratches are not permitted at all.

**Acceptable**



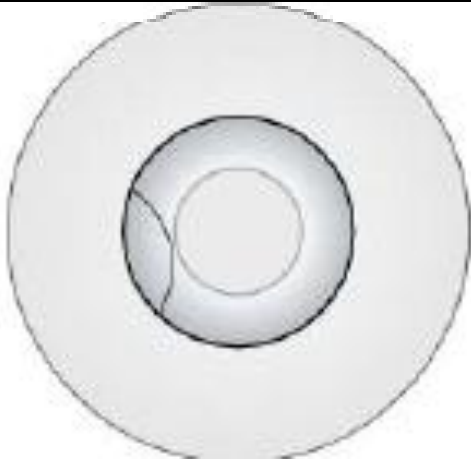
**Not Acceptable**



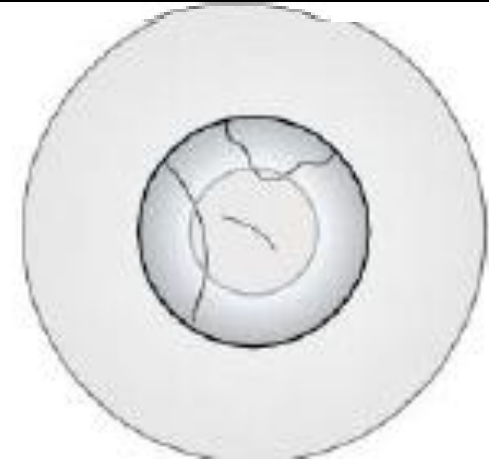
# Inspection: Termini Examination

- Cracks are not permitted to extend into the core.
- Any crack that enters but does not exit is not acceptable.

**Acceptable**



**Not Acceptable**



# Inspection: Termini Examination

- Pits or spalls of any size are not allowed on the core.
- A few pits are allowed in the cladding as long as it does not exceed a total of 5% of the cladding area.

**Acceptable**

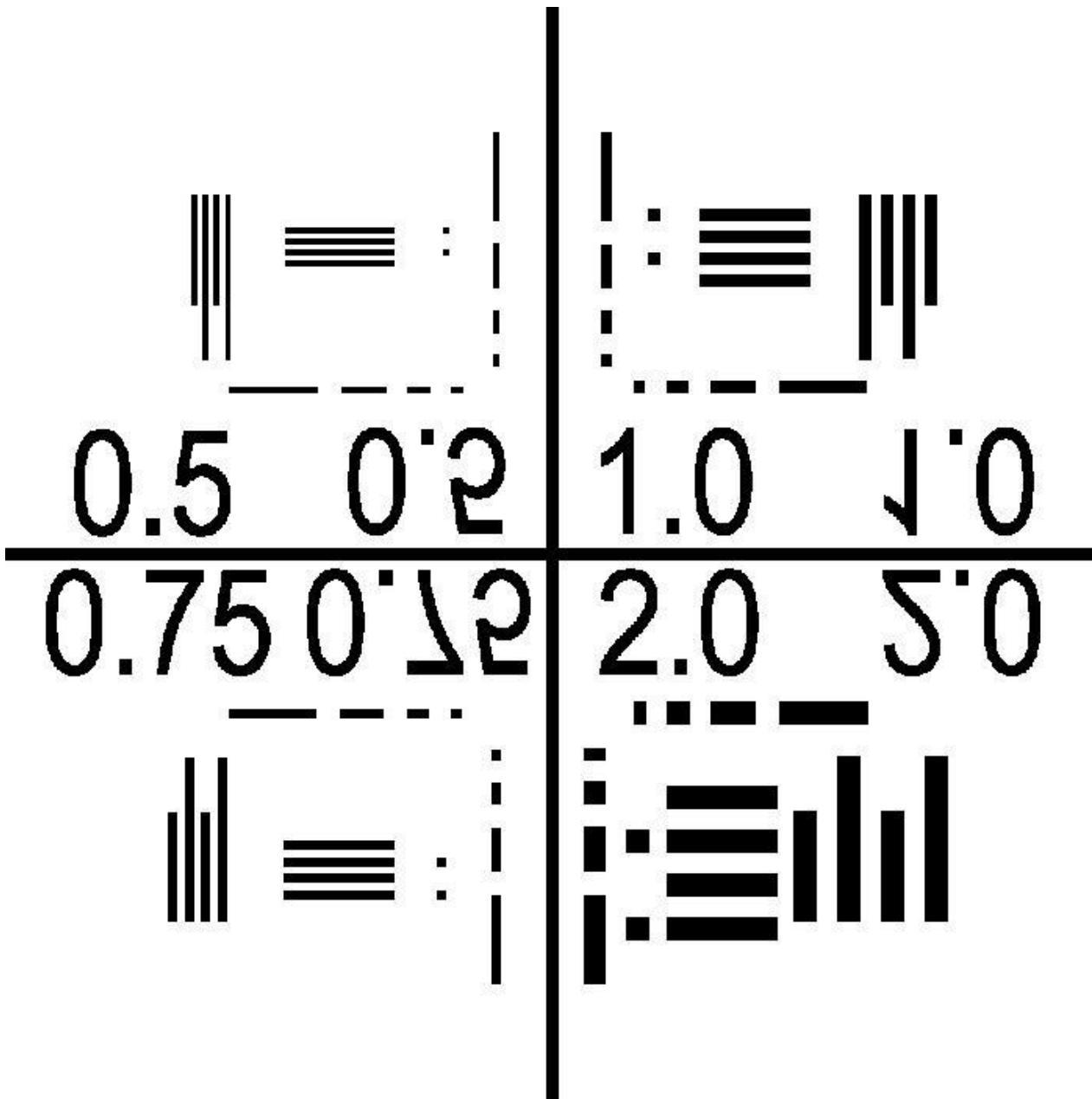


**Not Acceptable**



# Inspection: Termini Examination

- The St reference artifact is used by the person inspecting the end-face of the fiber optic terminus to calibrate their eyes so they may quantify the pits and or scratches based on the inspection criteria.
- The end-face of the ST reference artifact should be cleaned prior to use and may be inspected the same as any other ST ferrule.
- To calibrate your eyes, view the end-face of the ST reference artifact at the same magnification that you will use to inspect the end-face of the ferrule with questionable scratches or pits that will not clean from the end-face.
- When you believe you have studied the hash marks enough, then inspect the questionable ferrule end-face.



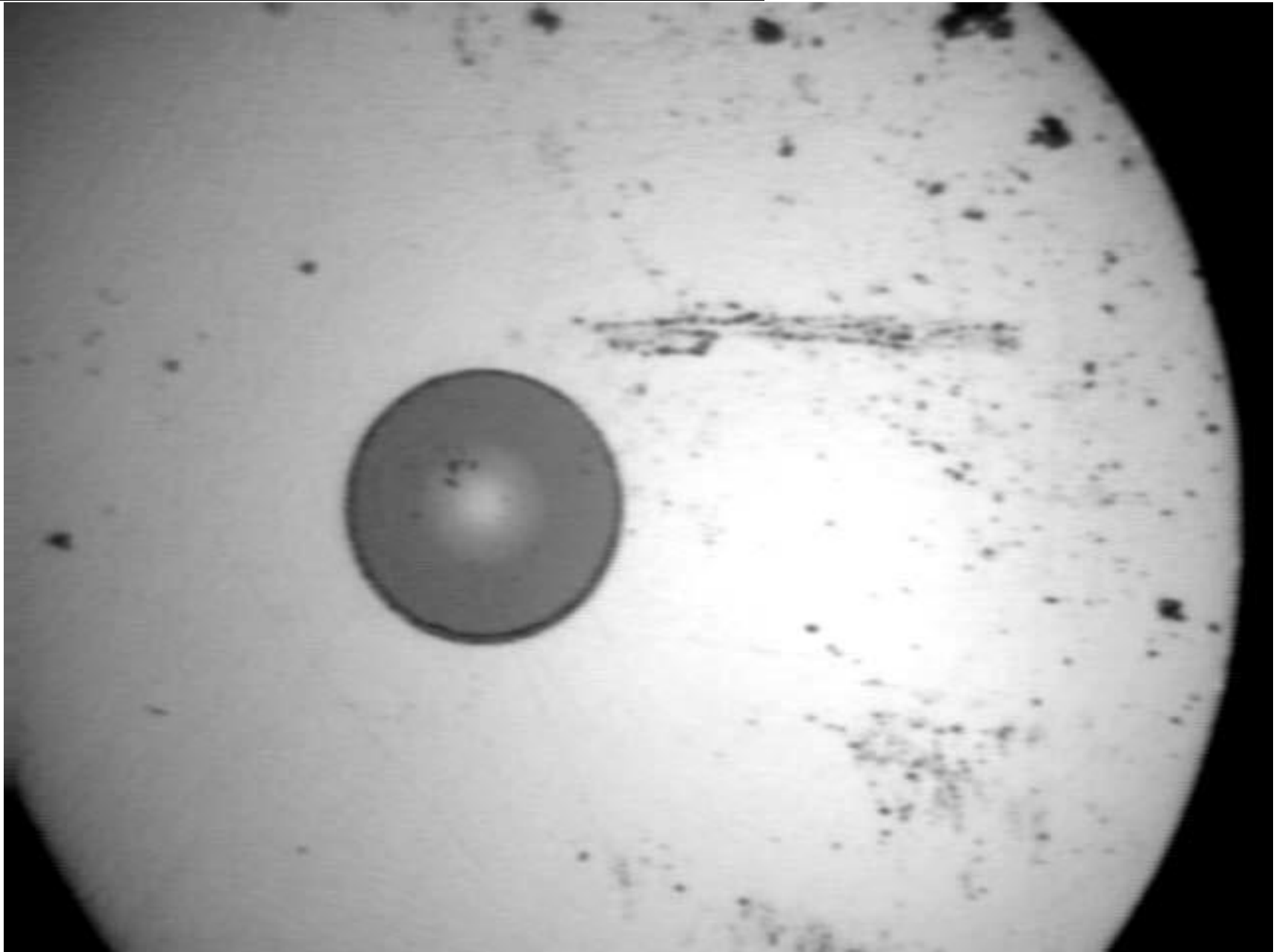
# Inspection

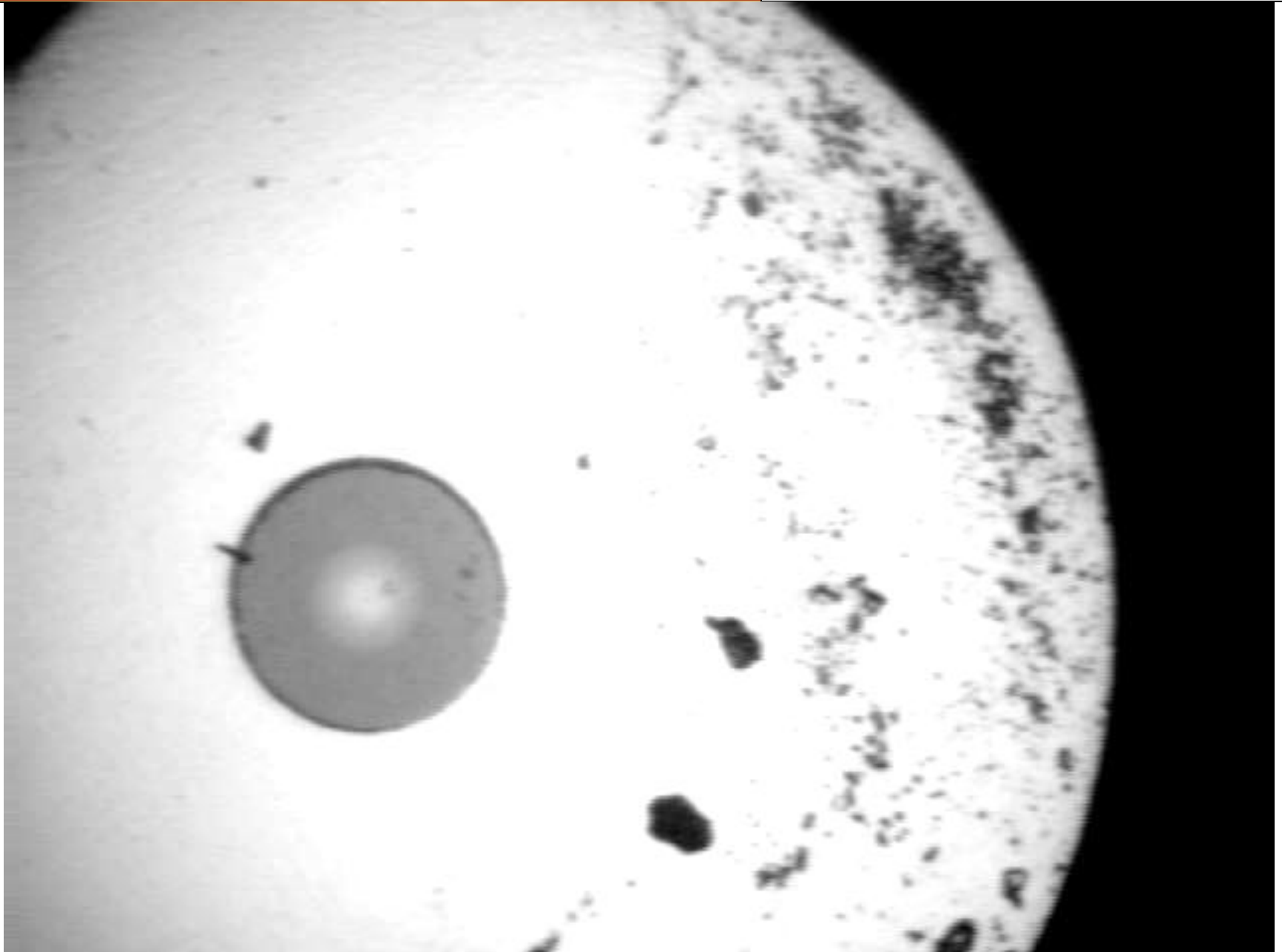
Now let's practice evaluating some termini end faces. The following slides will show you some examples.

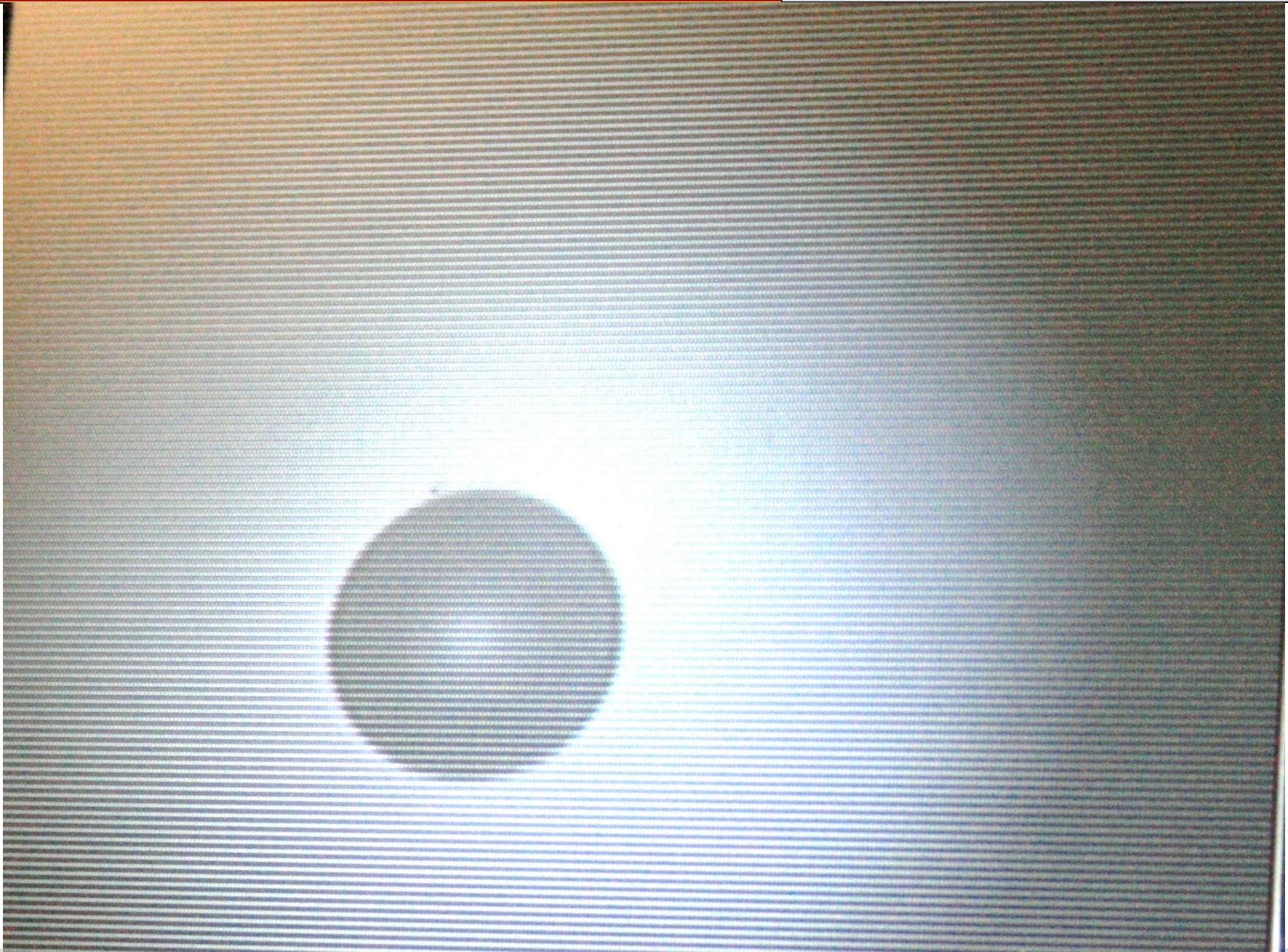
How do they look?

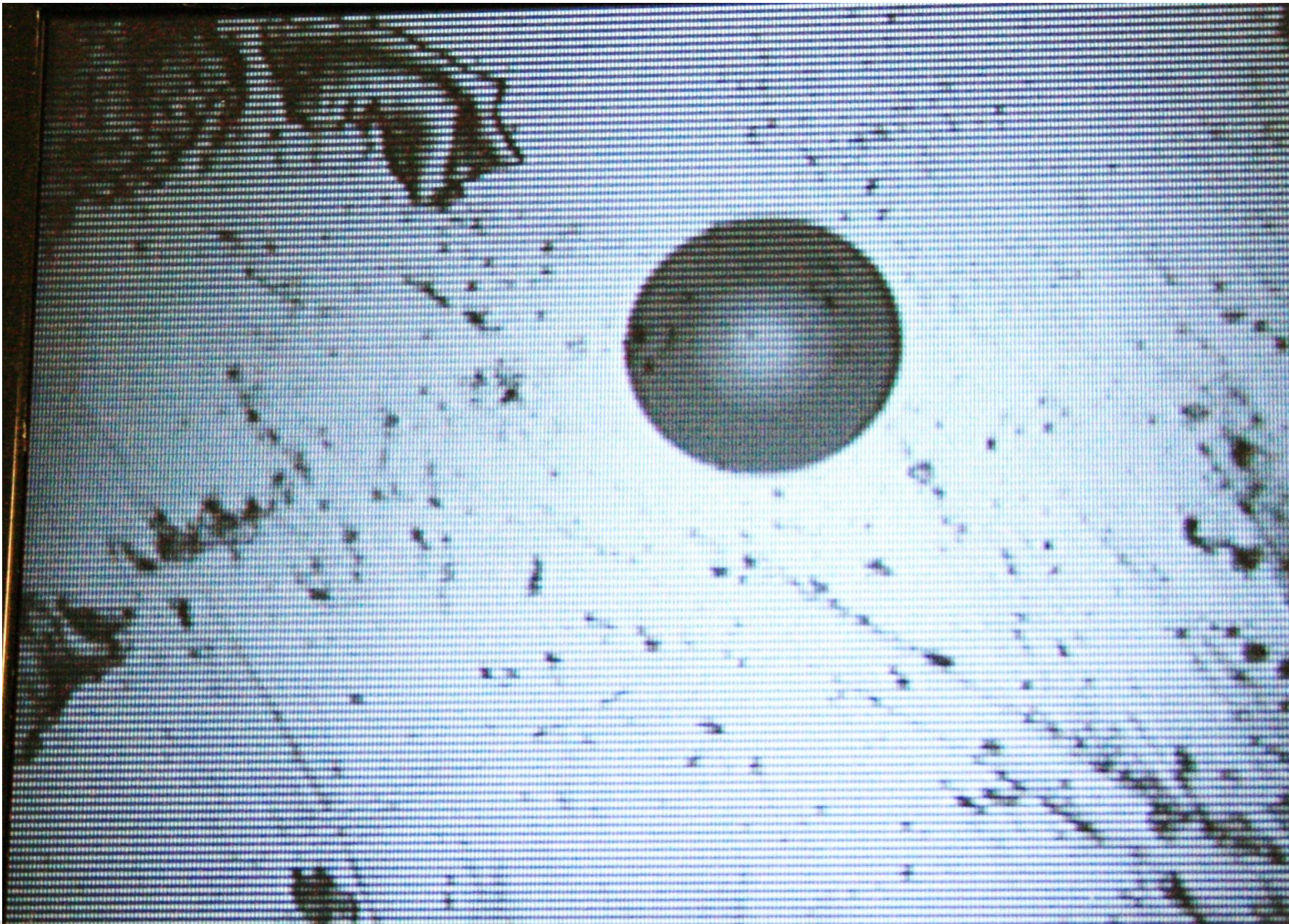
- If they are good tell me.
- If they are bad tell me why.

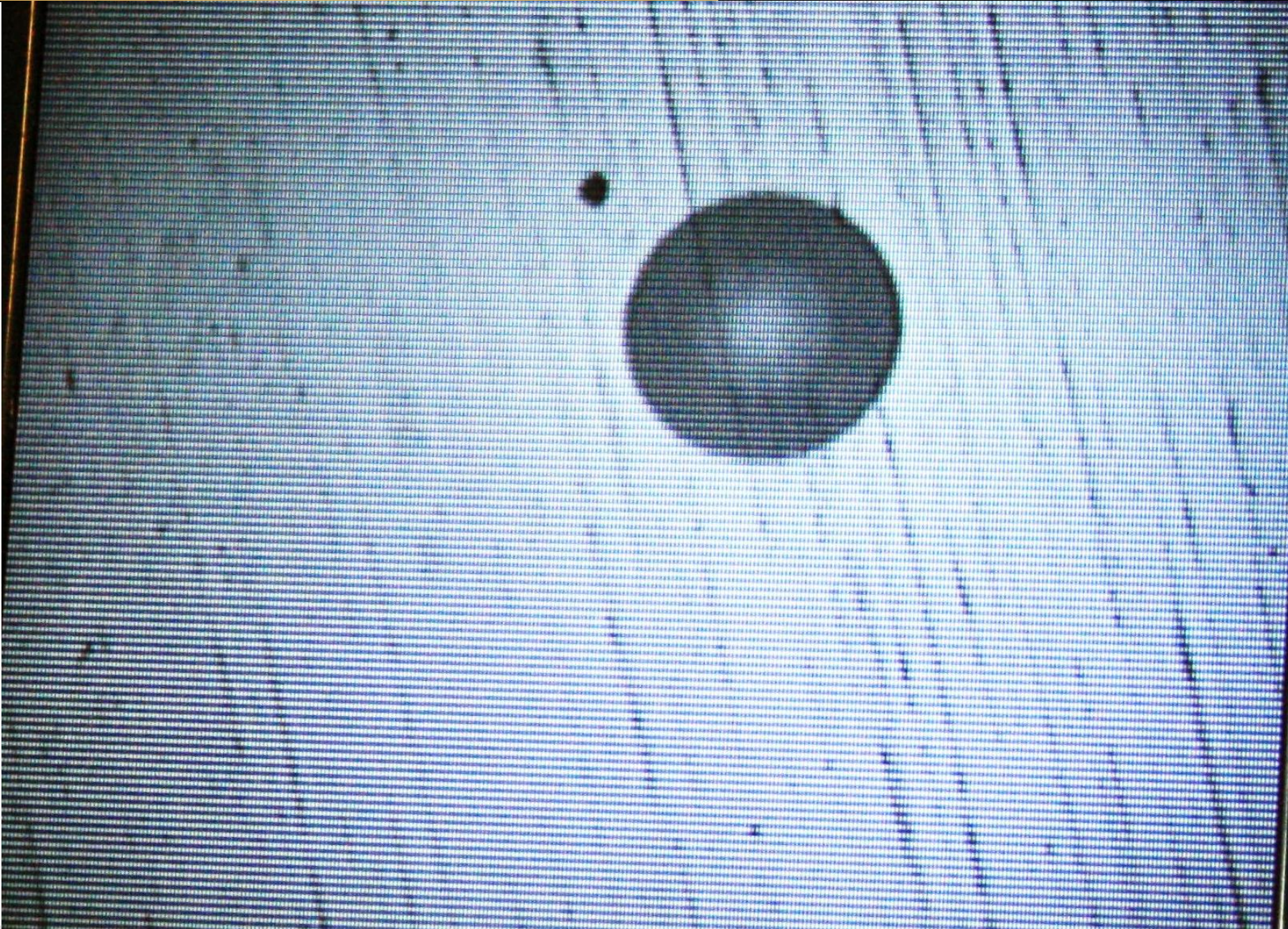


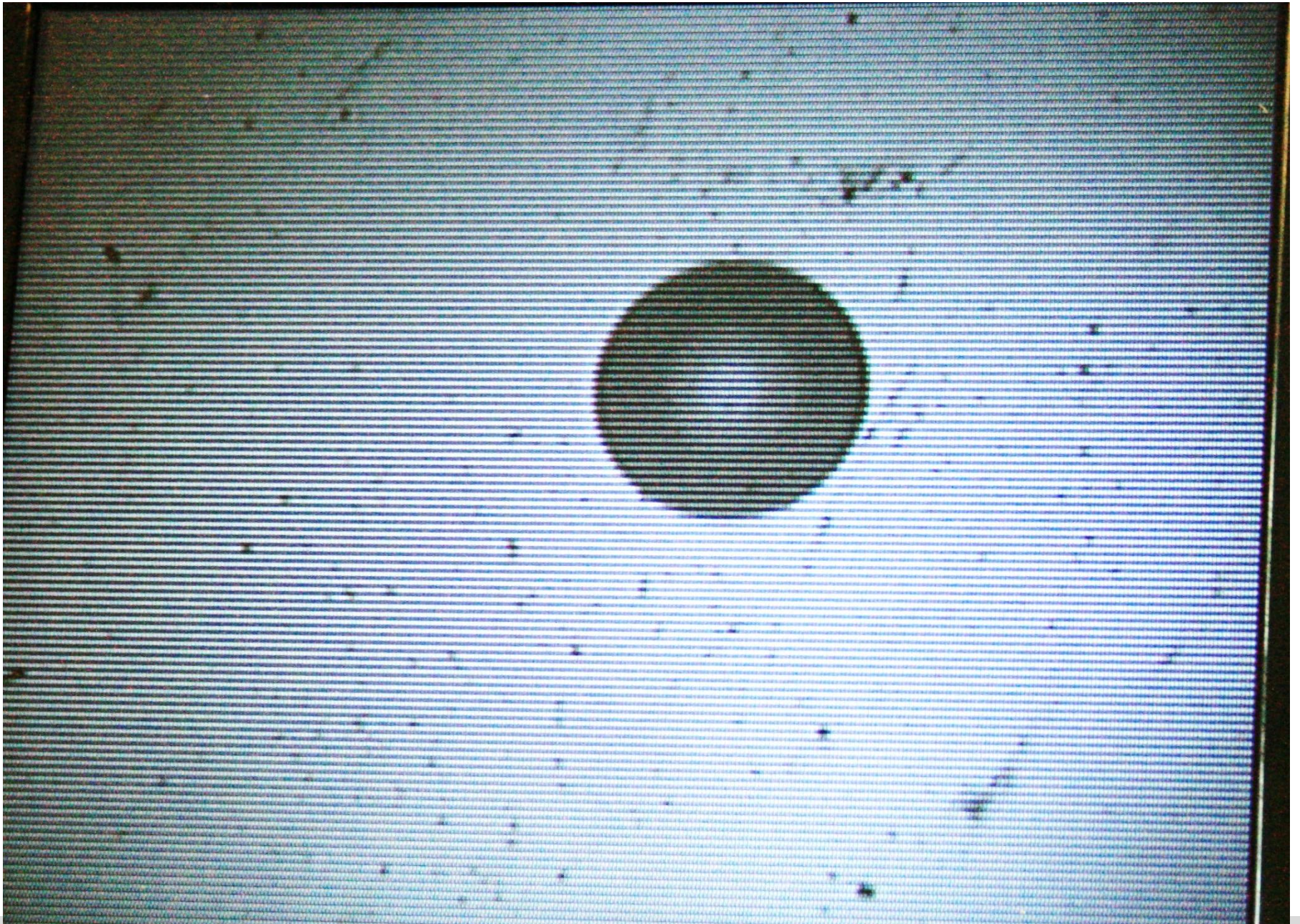


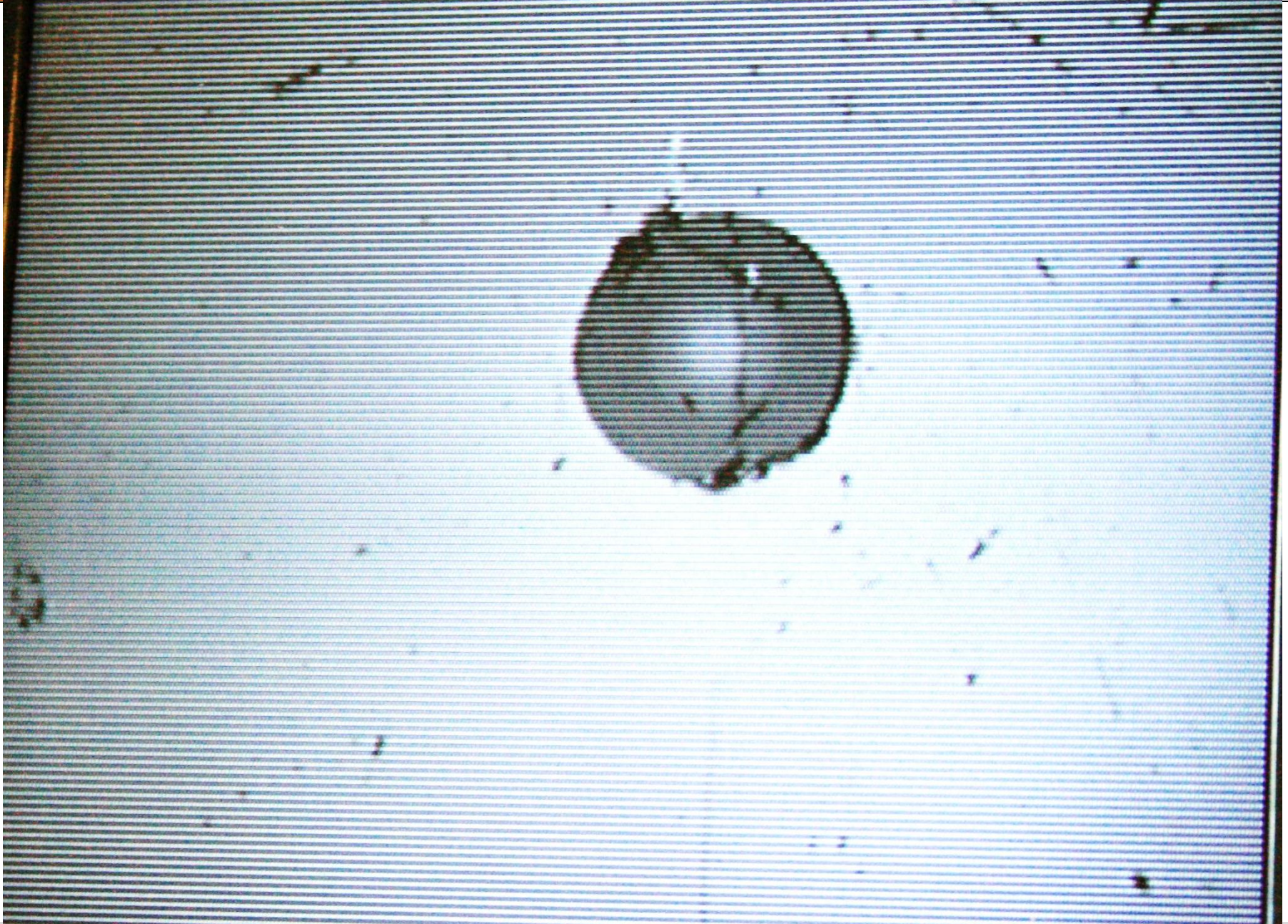


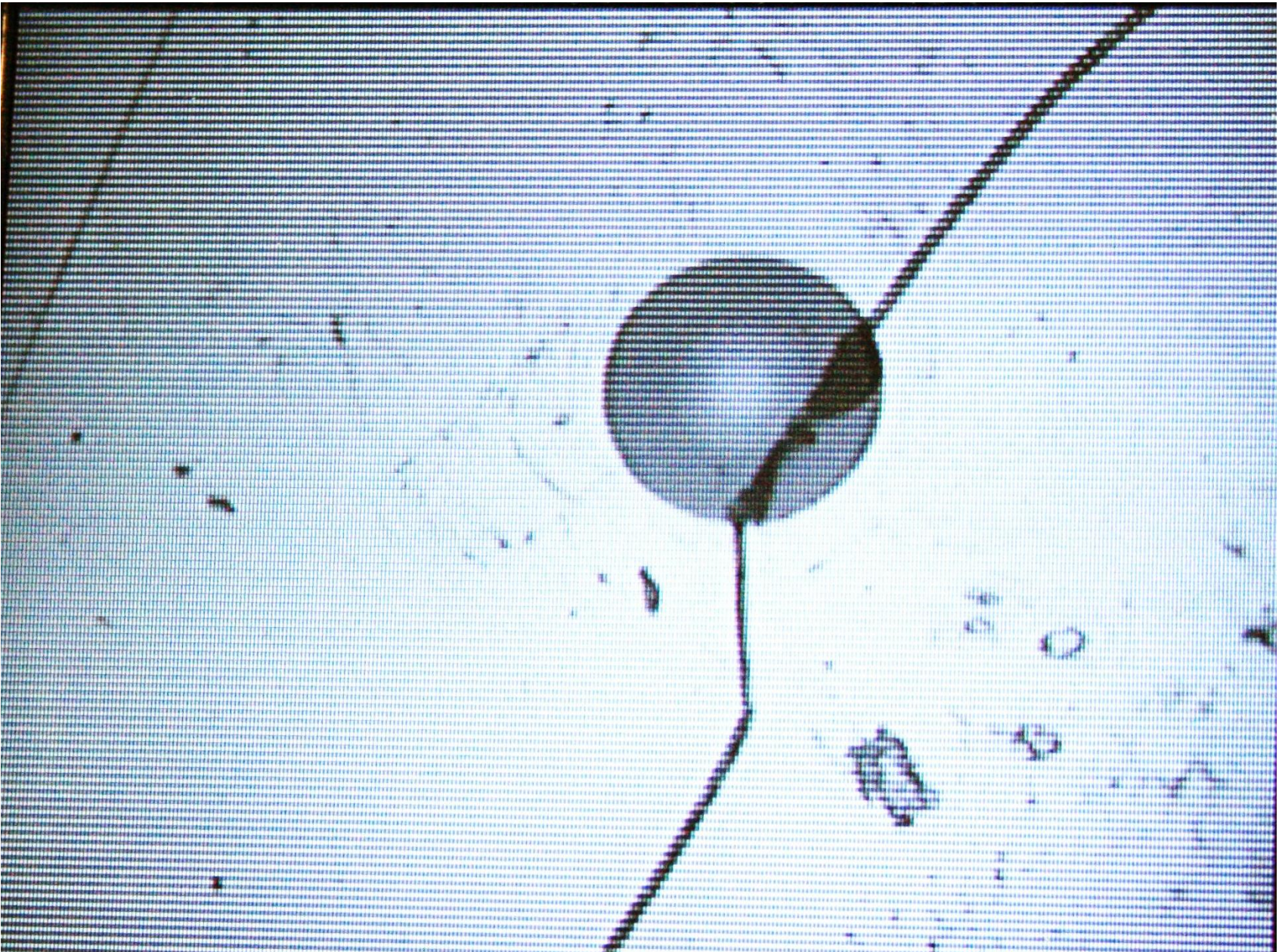




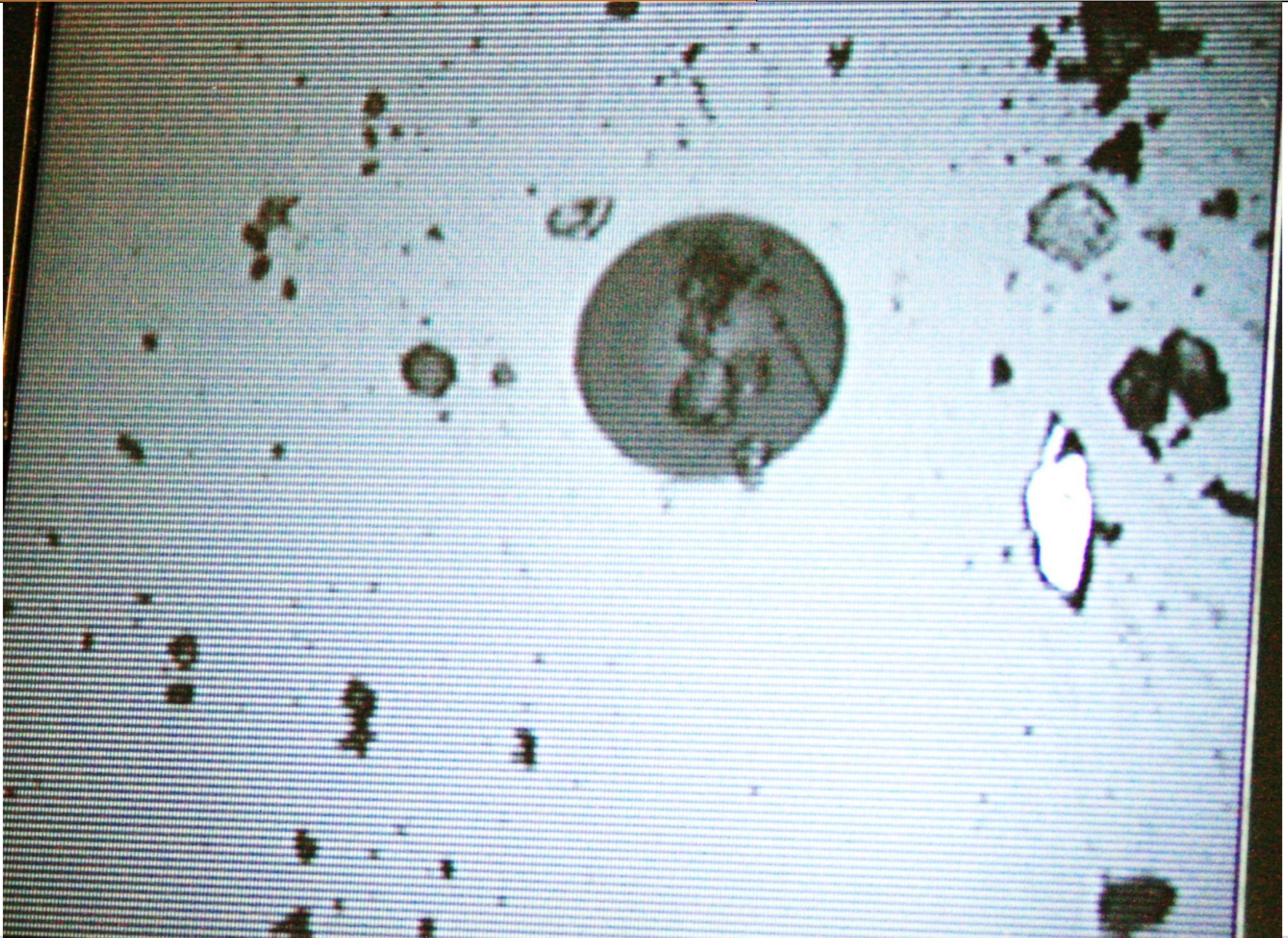












# Check Your Understanding

What is Continuity Testing and why is it important?

What steps are involved in end face examination?

What do you need to know to properly perform an inspection?

# Exercise: End Face Examination

**Practice inspecting fiber optic cables with a fiber scope.**

- Use the fiber scope to examine the end face of the fiber optic cables you have routed.
- Identify all that you believe are acceptable as is.
- Explain why they are acceptable?
- Identify all that you believe are unacceptable.
- Explain why you believe they are unacceptable?
- Lightly touch the end face of one of the termini that you believe is acceptable.
- Examine the end face that you just touched.
- What difference did you see?

# Conclusion

Any Final Questions?