Sight Glass Drainability & Holdup Volume Quantification Testing Procedure and Report

By

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July 21, 2014

Purpose –

The objective of this procedure is to observe and verify the Drainability of a variety of sight glasses used in the biopharmaceutical and pharmaceutical industries.

Scope –

The procedure will be applied to the industryôs most common suppliers of sight glasses, LJ Star, Steriflow, Jacoby Tarbox, BBS, and Sanitary Process Company. Each manufacturer has supplied a 1.5ò sight glass each with a unique construction. The test will be performed at 1/8 inch per foot slope and ¼ inch per foot slope. First the sight glasses will be placed at 1/8 inch per foot, with the sight glass to the left of the pipe. Then it will be moved down to 1/4 inch per foot slope. After this the sight glass will be placed to the right of the pipe at first 1/8 inch per foot, followed by ¼ inch per foot slope. This will ensure proper draining, that meets the biopharmaceutical industries slope requirements.

Responsibilities –

Two of CBCôs interns with the help of a Project Manager shall be responsible for generating the Drainability and holdup volume reports and shall ensure that all the portions of this document are met. The Quality Assurance department shall execute all tests and complete all the test reports.

Reference Documents –

LJ Star Sight Glass Literature/ Engineering Data
Steriflow Sight Glass Literature/ Engineering Data
Jacoby Tarbox Sight Glass Literature/ Engineering Data
BBS Sight Glass Literature/ Engineering Data
Sanitary Process Company Sight Glass Literature/ Engineering Data
Cotter Brothers Corp-Testing Setup Drawings
Cotter Brothers Corp-Drainability & Holdup Volume Testing Standard Operating Procedure

Drainability/Holdup Volume Testing Equipment-
Sight Glasses
Pressure Gauge (Calibrated)
Centrifugal Pump
Pump Speed Controller
Digital Timer
Digital Camera
Level

Safety Equipment-
Safety Glasses
Safety Shoes

Sight Glasses-

1ò TC x TC LJ Star Prototype Sight Glass
1-1/2ò TC x TC Steriflow Sight Glass
1-1/2ò TC x TC Jacoby Tarbox Sight Glass
1-1/2ò TC x TC BBS Sight Glass
1-1/2ò TC x TC Sanitary Process Comp. Sight Glass
1-1/2ò TC x TC LJ STAR SVF-A15 Sight Glass

Technique –

Test each manufacturerôs 1-1/2ò TC x TC Sight Glasses, using the Cotter Brothers Testing Rig, shown in the test report. All factors will be held constant in each test, and the only factor changed will be the sight glass used. The slope of the testing rig, the pressure of the testing rig, and the flow rate of water through the rig will remain constant. One test was done for each sight glass, and a picture was taken in order to capture the amount of holdup remaining in each sight glass.

Four series of sub experiments will be conducted to verify the repeatability of the experiment. First the piece of pipe will be placed up slope of the sight glass with a slope of 1/8 inch per foot slope. Next the slope was lowered to ¼ inch per foot slope. Next step was to flip the sight glass so that the piece of pipe was placed down slope of the sight glass. First this was used with a slope of 1/8 inch per foot slope, then ¼ inch per foot slope. The reason for switching the side of the pipe was in order to ensure that the piece of pipe had no effect on the observable buildup in the sight glass. The technique used ensured that we would be able to conduct a standard test to obtain repeatable results.

Procedure –

In order for the Sight Glass Drainability & Holdup Volume test to be tested in a way that ensures accurate, precise and repeatable results the following steps must be followed:

1. Ensure that the High Point vent and low point drain are both closed.
2. Set the pump at 60 gpm for 3 minutes.
3. The pressure measured in the system must be held at a constant 10 psig.
4. Open the high point vent and the low point drain.
5. Open the system and allow it to gravity drain for 3 minutes.
6. After 3 minutes, take a picture of the sight glass showing the amount of buildup, and quantitatively record how much buildup is present.
7. Repeat steps 1-6 with a new sight glass.

Documentation –

See attached visual test results and data.

Summary –

This drainability and holdup volume test procedure was generated and executed in order to observe the actual holdup volume retained in various manufacturersô sight glasses in constant test conditions. To install the sight glasses on the system we used PTFE gaskets to eliminate any gasket intrusion that may have prevented any water from draining.

The findings of this study conclude that there is in fact holdup within the sight glasses. The pictures show that after proper draining time, there is in fact a visible amount of buildup in nearly all sight glasses, at all slopes. We were able to conclude through Profilometer testing that the holdup volume in the most popular commercially available sight glasses used in the biopharmaceutical and pharmaceutical industries is greater than two feet of tubing of the same 1-½ò tubing.

We also were able to conclude that the placement of the pipe, whether it was placed to the left or to the right of the sight glasses made no quantifiable impact on the amount of buildup that was able to collect on the sight glasses.

After conducting our profilometer readings, we also determined that the measured Ra, on both the right sides and the left sides of the sight glasses, tended to have different readings. Refer to the glass profilomter readings in the table below to see. We were able to obtain consistent readings on one side with all of the sight glasses, but after taking readings of the other side of the glass, we obtained slightly different numbers. We were unable to determine the cause of this difference of readings between the left and right sides of the sight glasses.

July 21st, 2014

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Sight Glasses
Profilometer Readings

A)

Left TC Ra	Right TC Ra	Average TC Ra
9	13	
13	15	
11	16	
		12.8

Glass Left Ra	Glass Right Ra	Average Glass Ra
7	6	
7	10	
7	10	
		7.8

B)

Left TC Ra	Right TC Ra	Average TC Ra
21	12	
24	12	
21	10	
		16.7

Glass Left Ra	Glass Right Ra	Average Glass Ra
6	6	
6	5	
5	5	
		5.5

C)

Left TC Ra	Right TC Ra	Average TC Ra
15	17	
14	17	
17	17	
		16.2

Glass Left Ra	Glass Right Ra	Average Glass Ra
9	6	
7	6	
9	9	
		7.7

D)

Left TC Ra	Right TC Ra	Average TC Ra
13	11	
15	13	
14	13	
		13.2

Glass Left Ra	Glass Right Ra	Average Glass Ra
4	7	
7	6	
7	6	
		6.2

E)

Left TC Ra	Right TC Ra	Average TC Ra
18	19	
18	19	
17	18	
		18.2

Glass Left Ra	Glass Right Ra	Average Glass Ra
5	7	
7	8	
7	8	
		7.0

?)

Left TC Ra	Right TC Ra	Average TC Ra
8	8	
12	10	
11	9	
		9.7

Glass Left Ra	Glass Right Ra	Average Glass Ra
7	6	
5	7	
5	6	
		6

Metal

ighest Ra Avg)	18.2
L est Ra Avg)	9.7

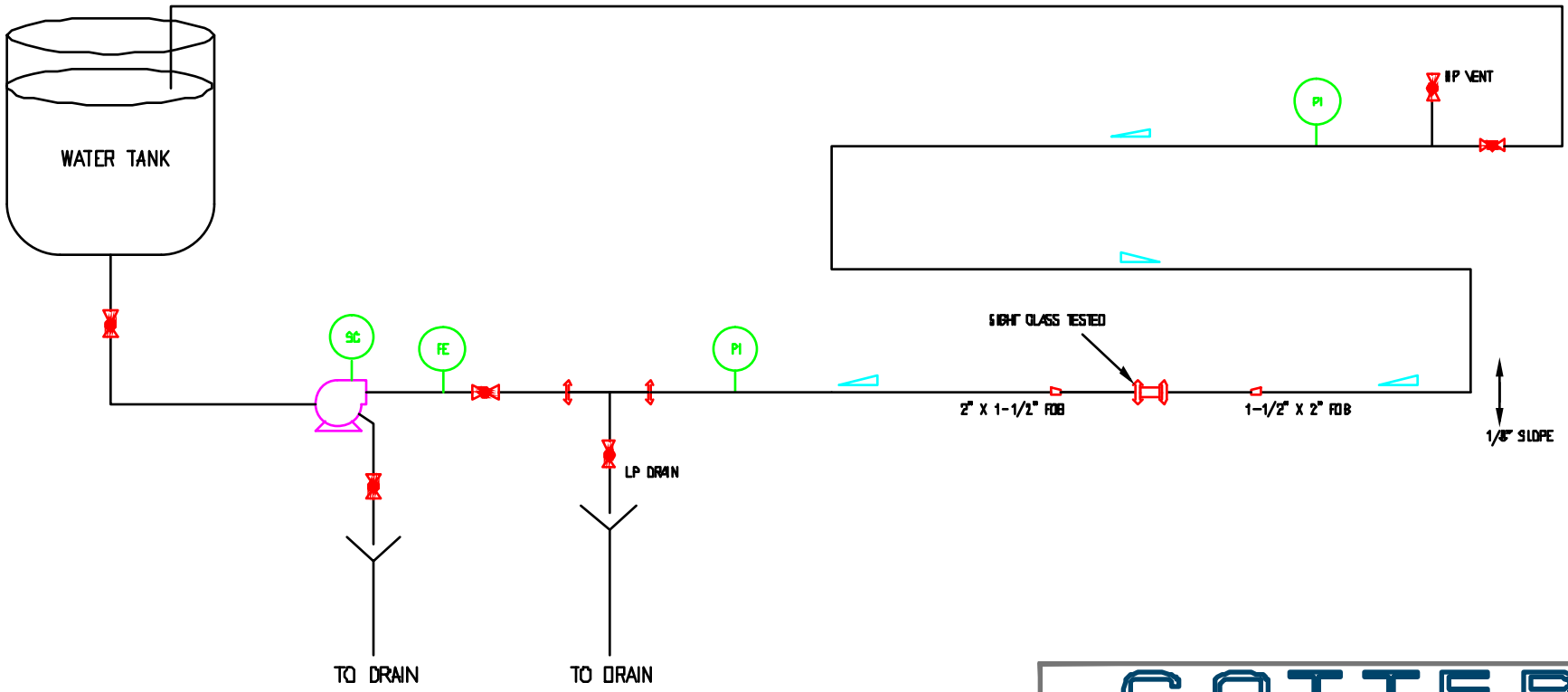
Glass

ighest Ra Avg)	7.8
L est Ra Avg)	5.5

Polypropylene Test Fixture Material
Profilometer Reading

Left Ra	Right Ra	Average Ra
4	5	
5	4	
5	5	
		4.6

ASME BPE SURFACE FINISH (SF) from Table SF-2.4-1
4 15 Ra Ele tr lished
5 20 Ra Ele tr lished
6 25 Ra Ele tr lished

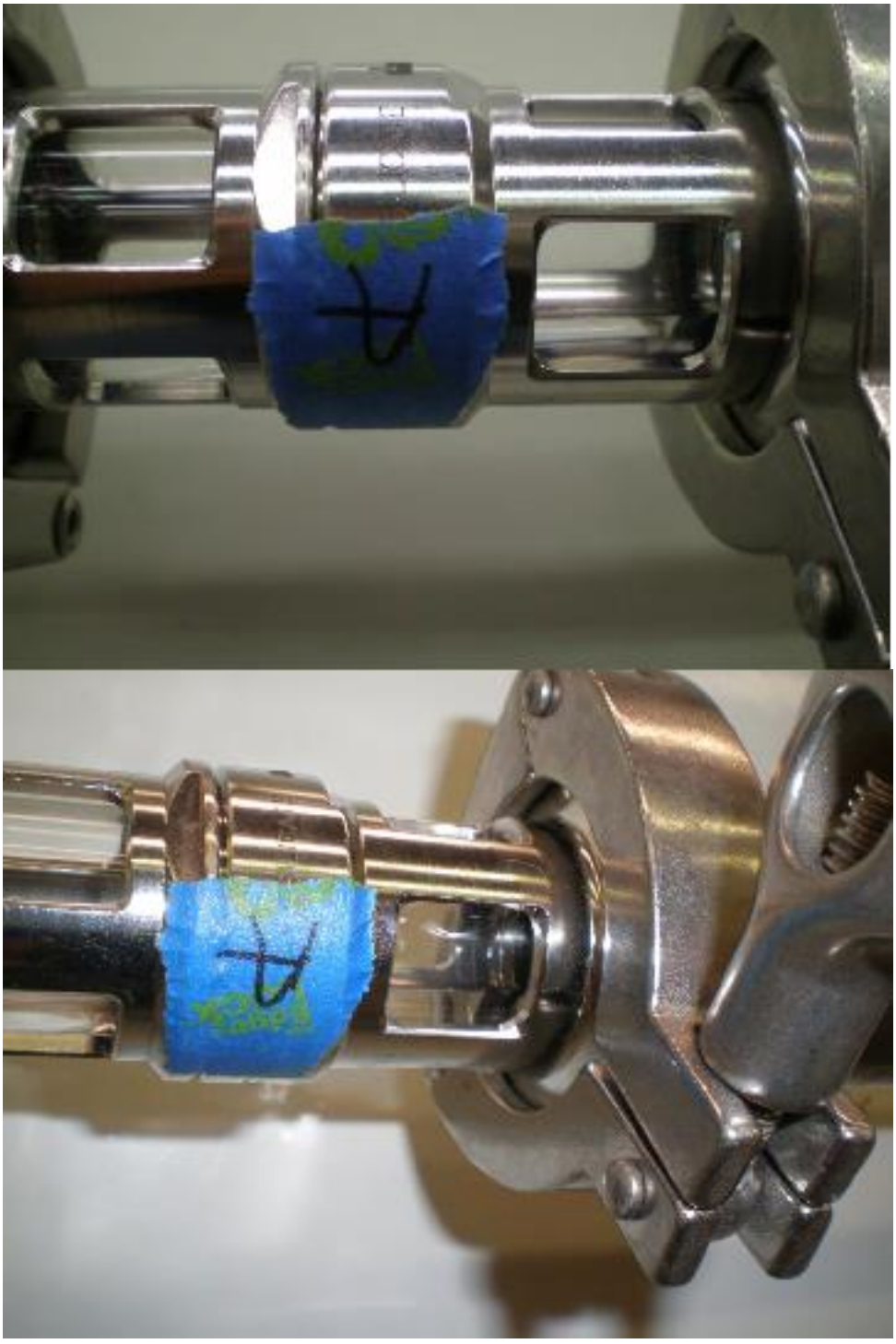


COTTER BROTHERS CORPORATION

Title	Drainability & Holdup Volume Study P&ID		
Drawn by	Evan Gaj	Date	7/22/14
Checked by	Randy Cotter	Date	7/22/14
Dwg. Type	P&ID	Scale	NTS
Drawing No.	Sight Glass Test	Sheet No.	PID01A
		Revision	

Test- Left Side of Line- 1/8” Slope

A)



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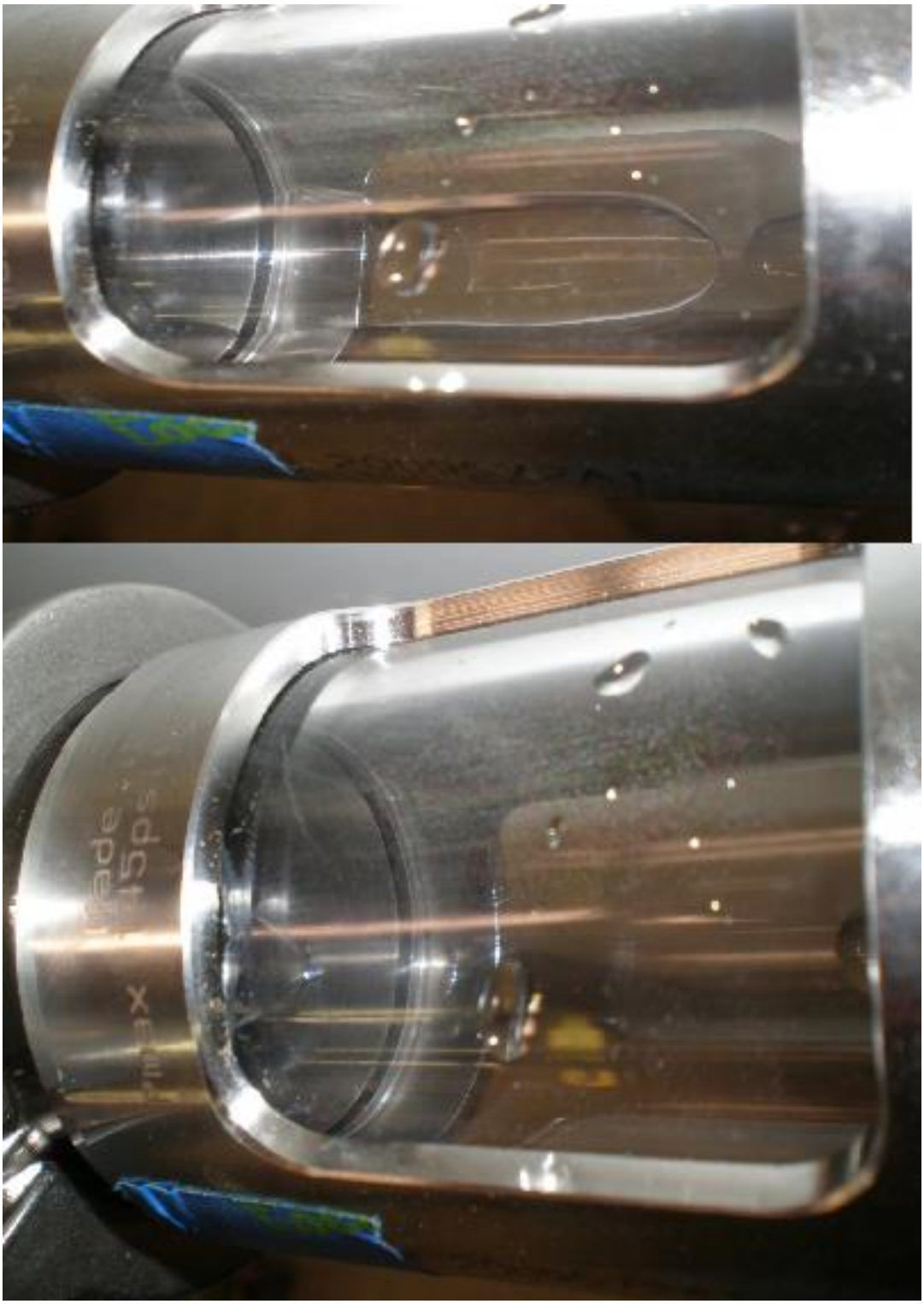

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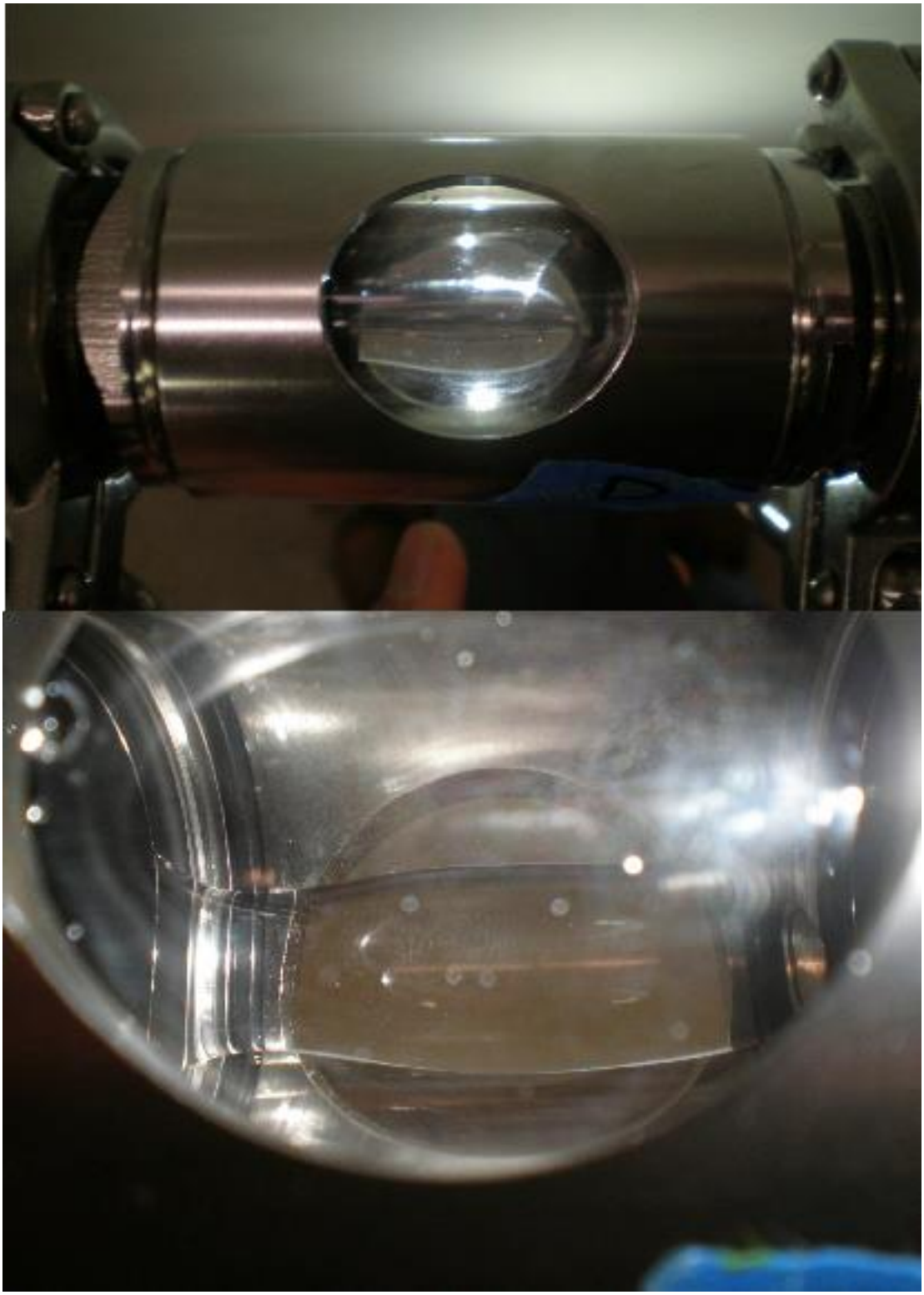

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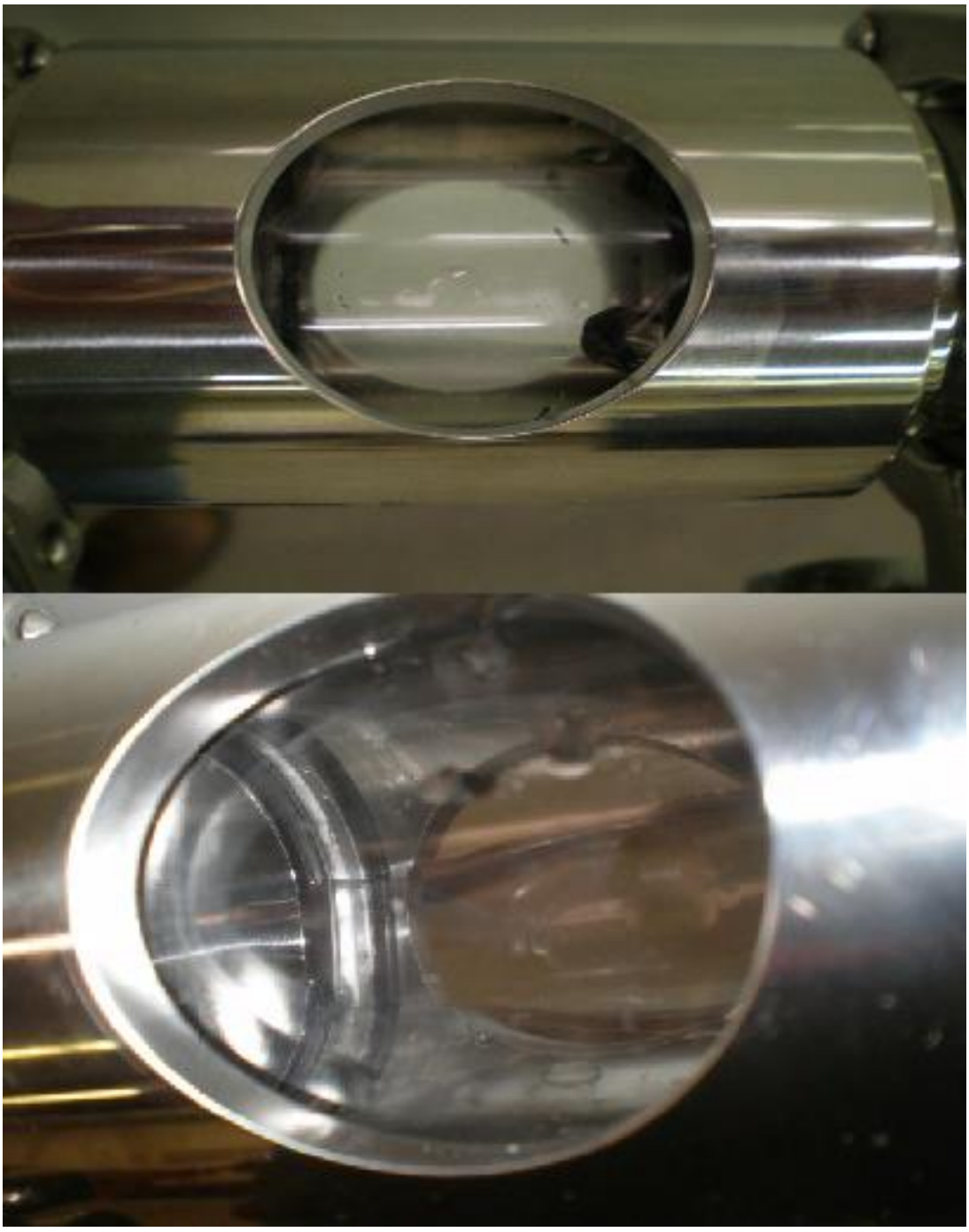

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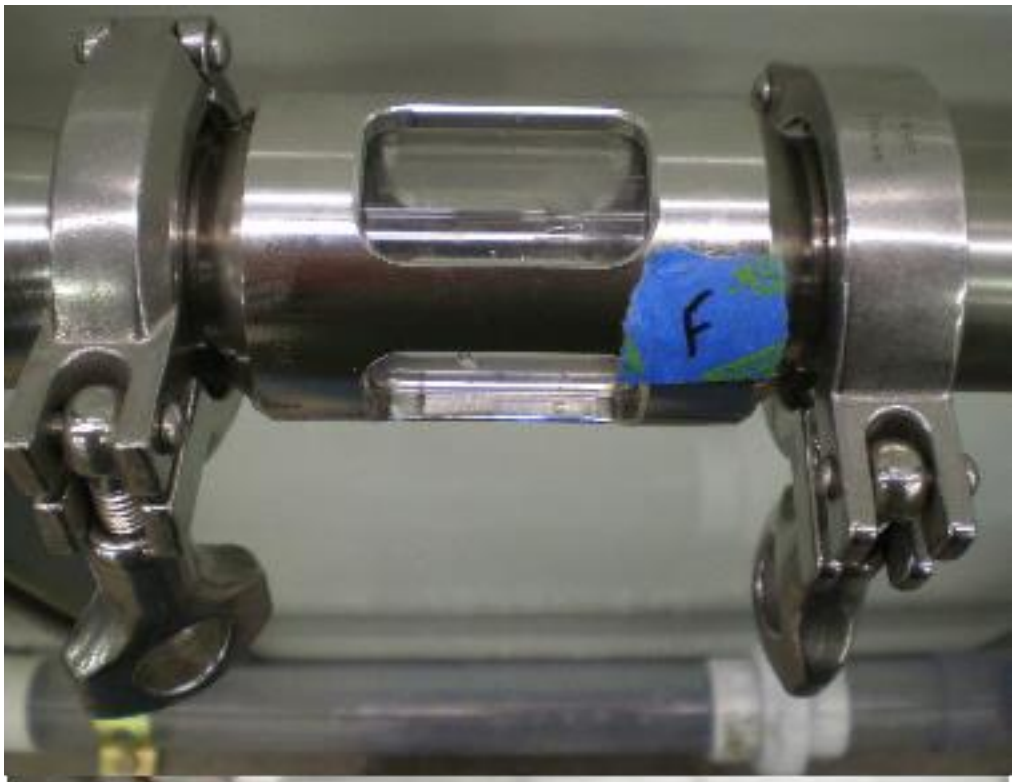
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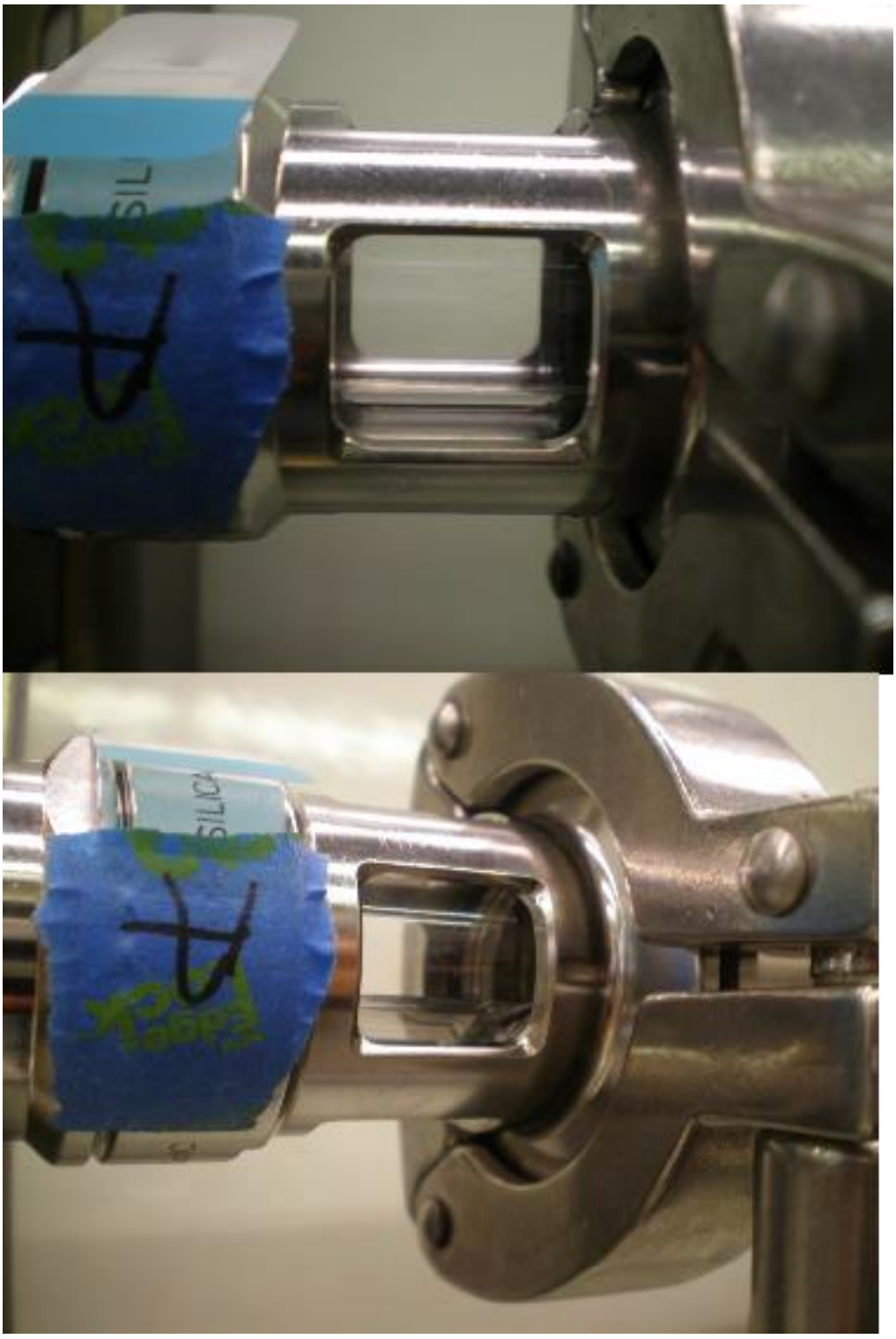
Test- Right Side of Line- 1/8” Slope

A)



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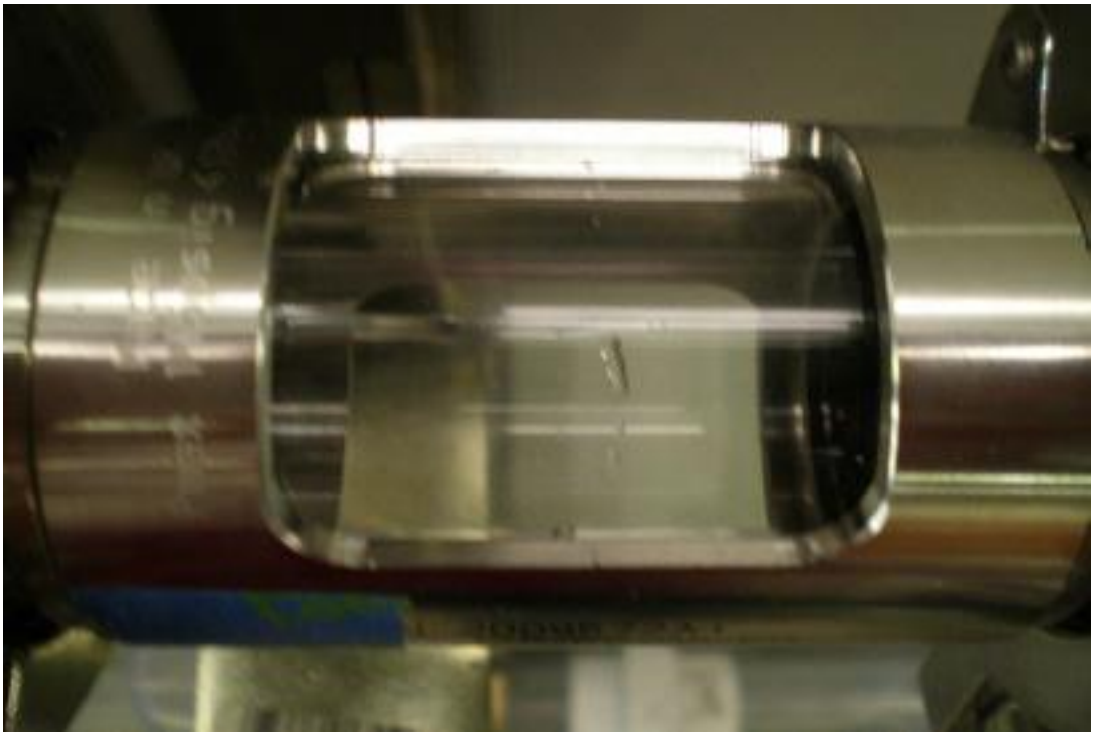

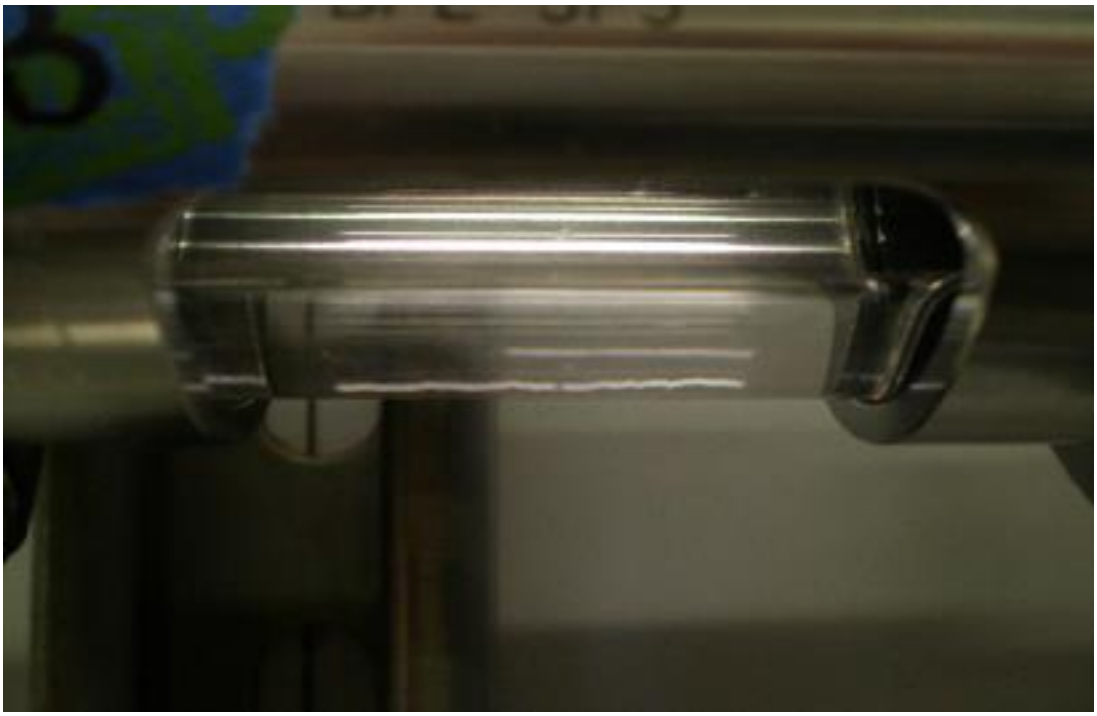

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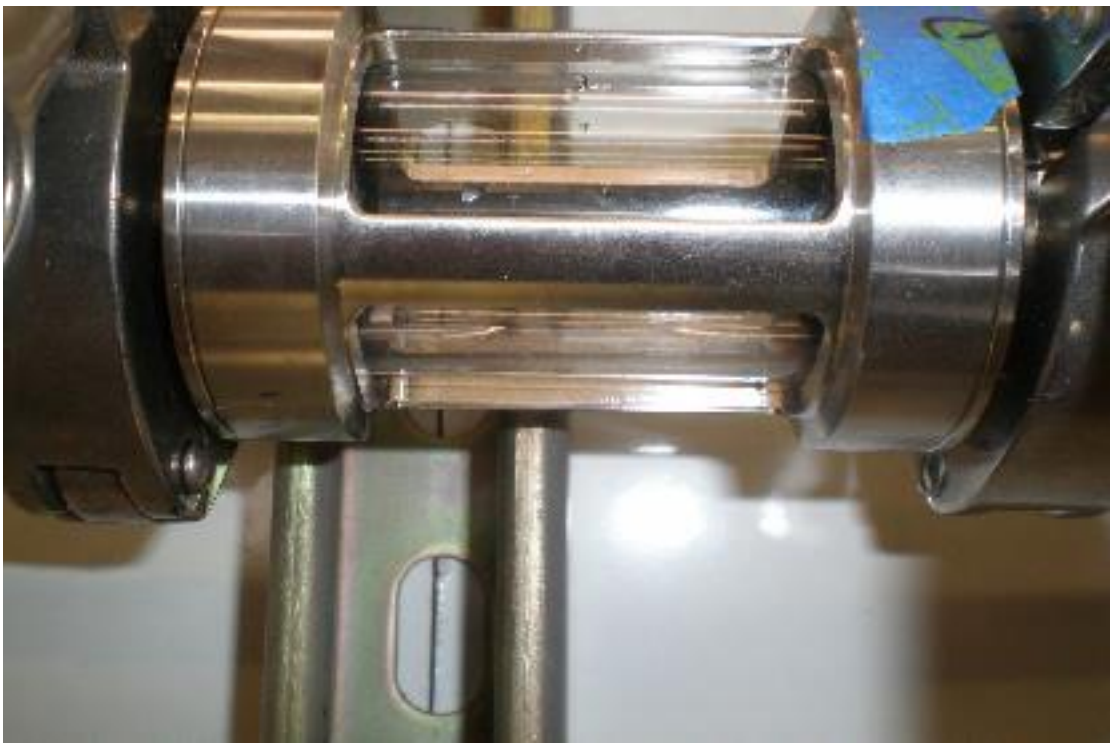

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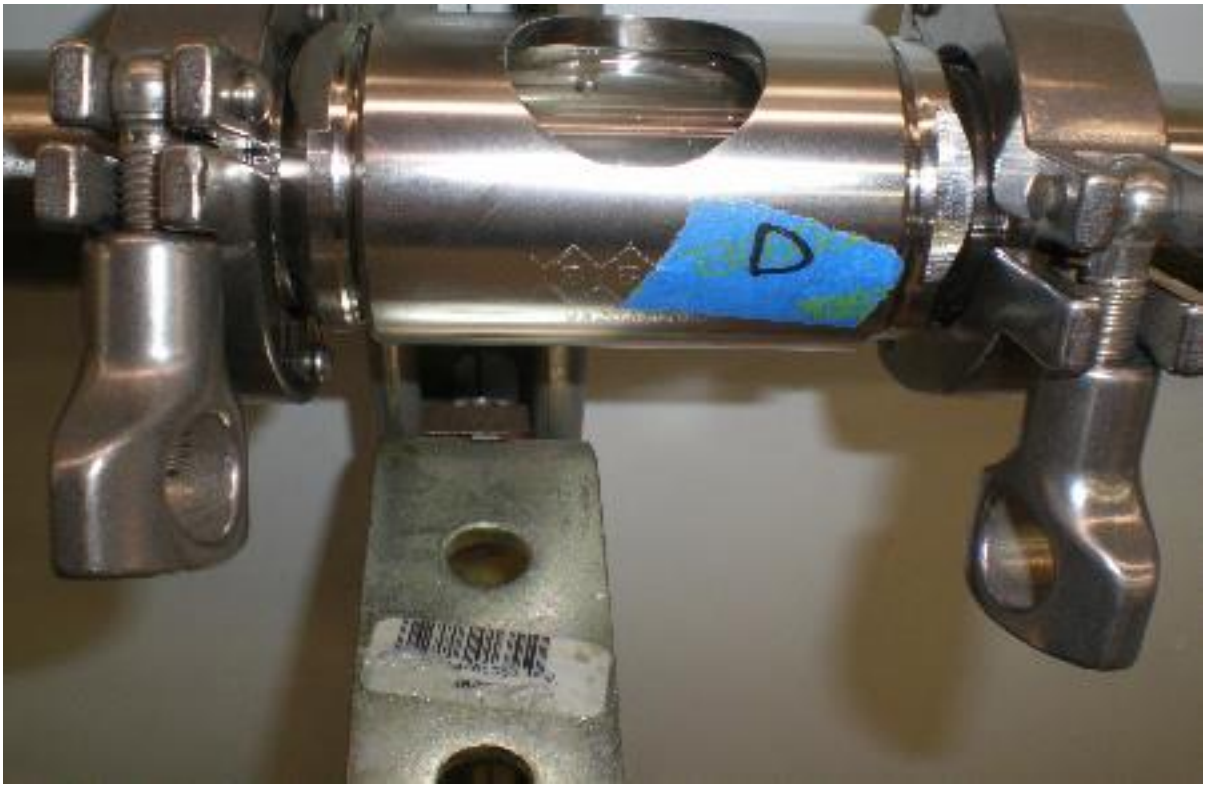

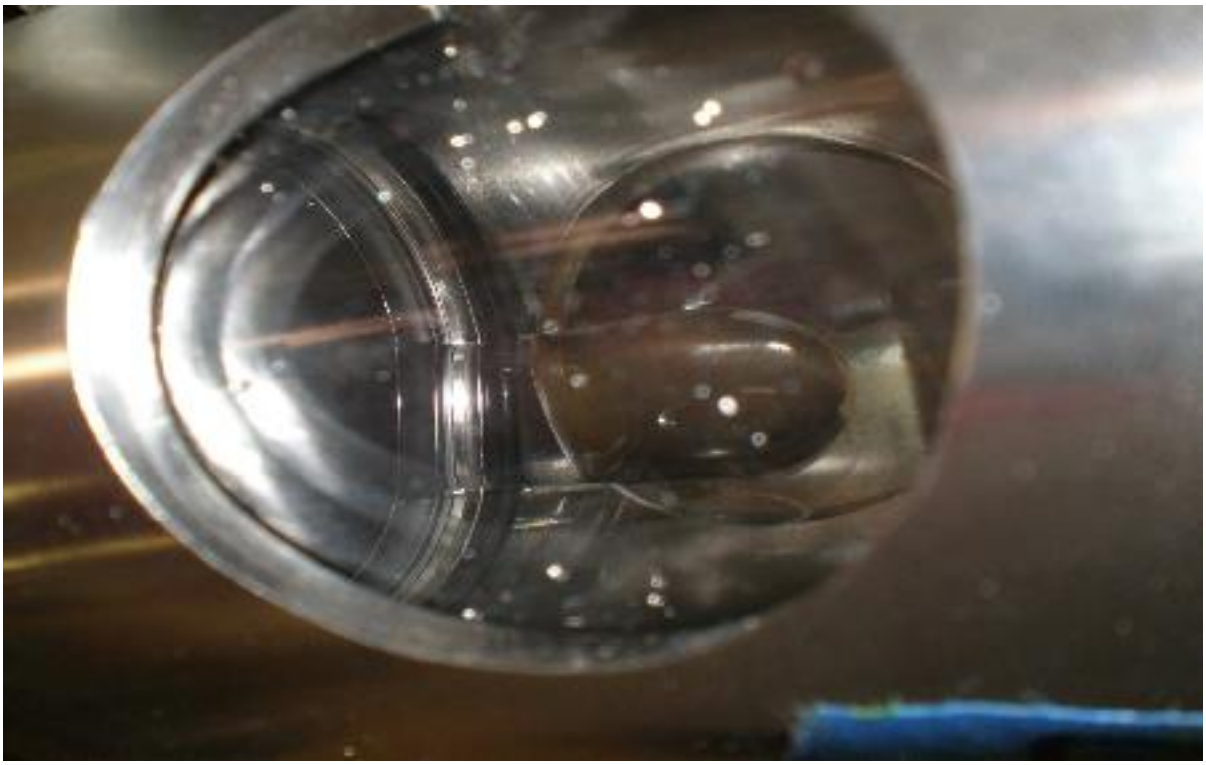

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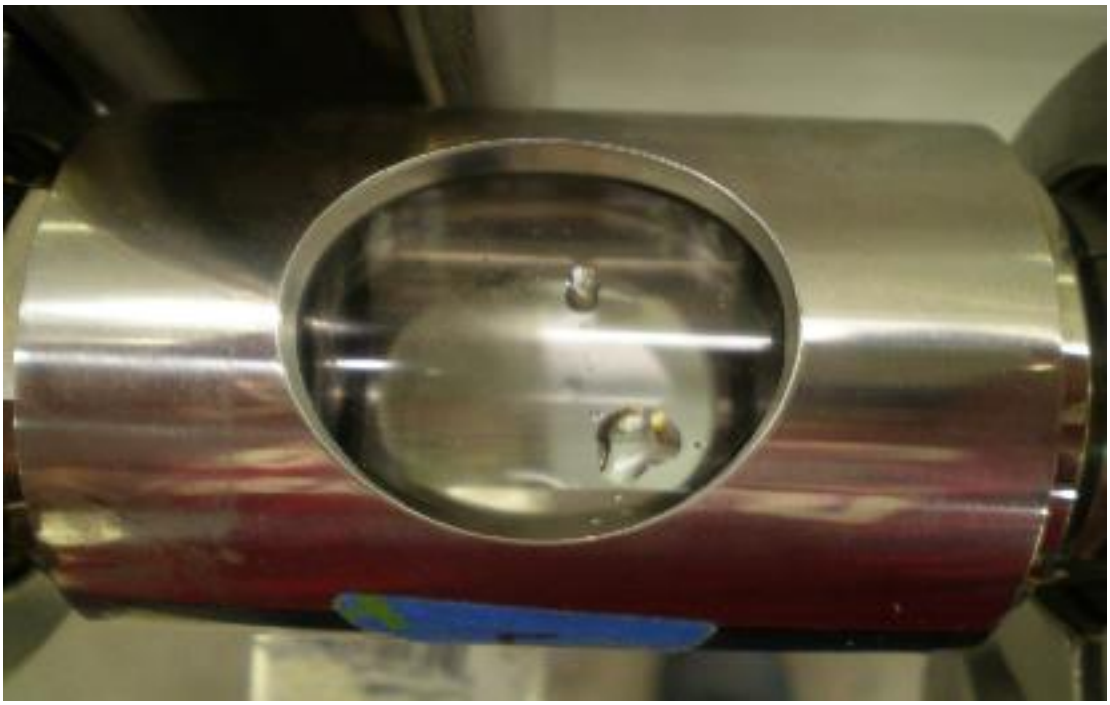

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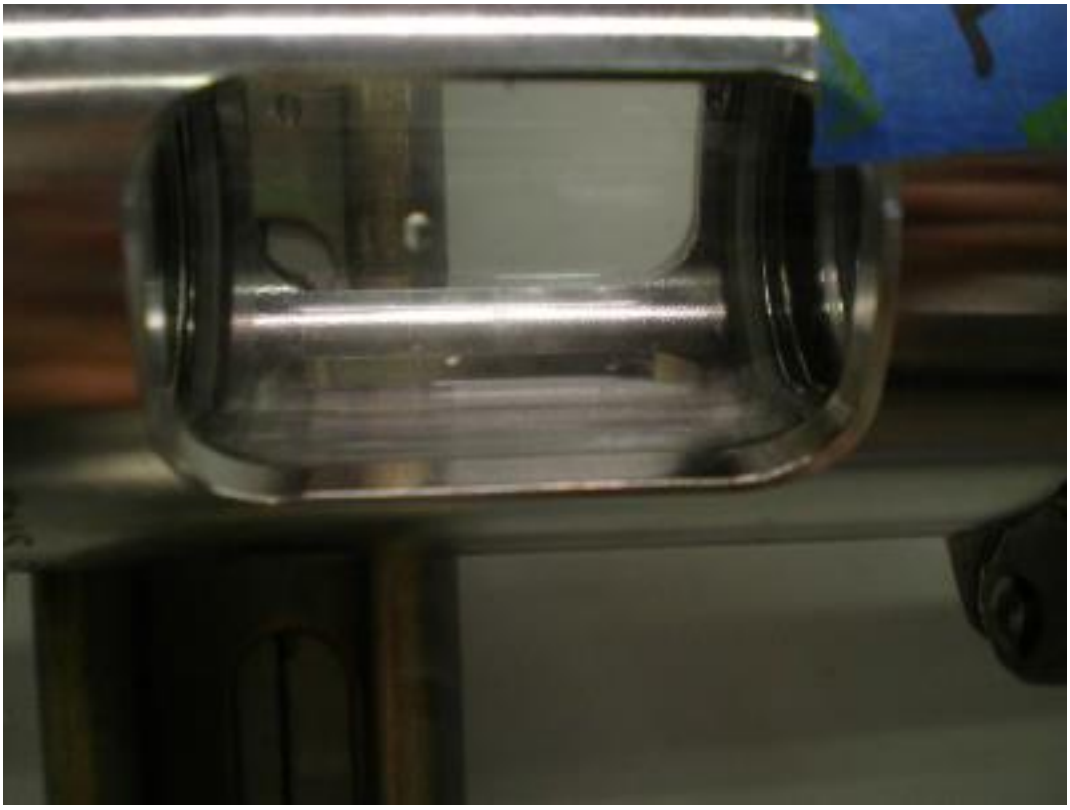

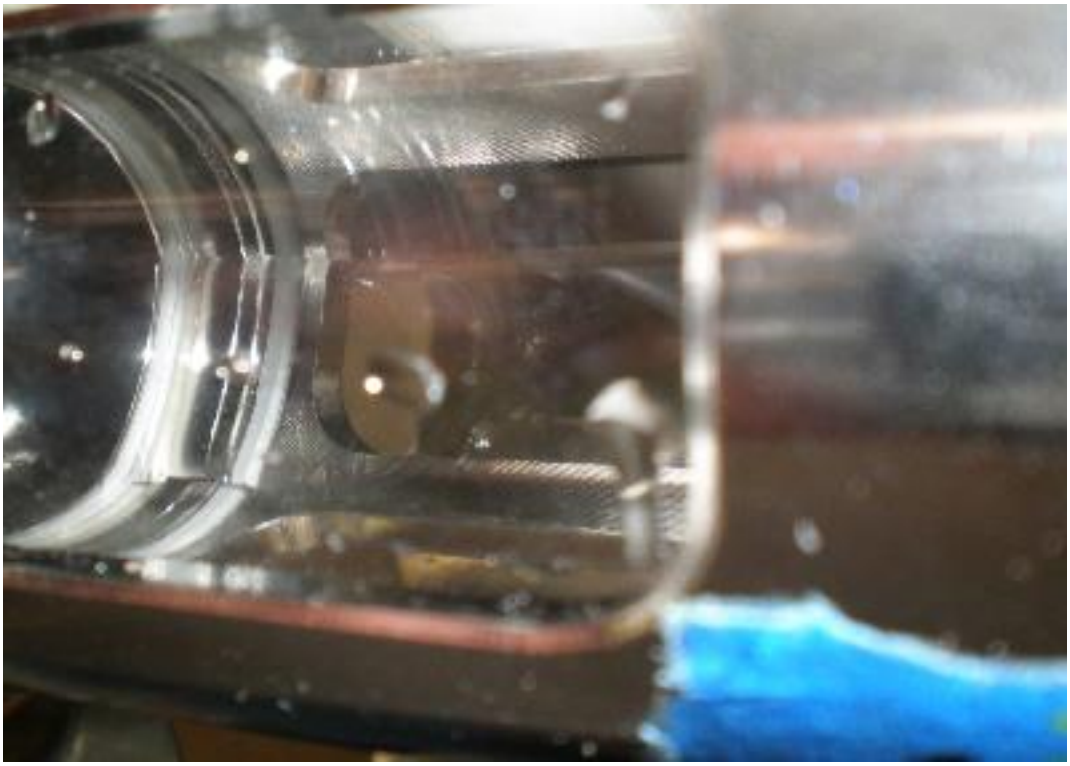

Test- Right Side of Line- 1/4” Slope

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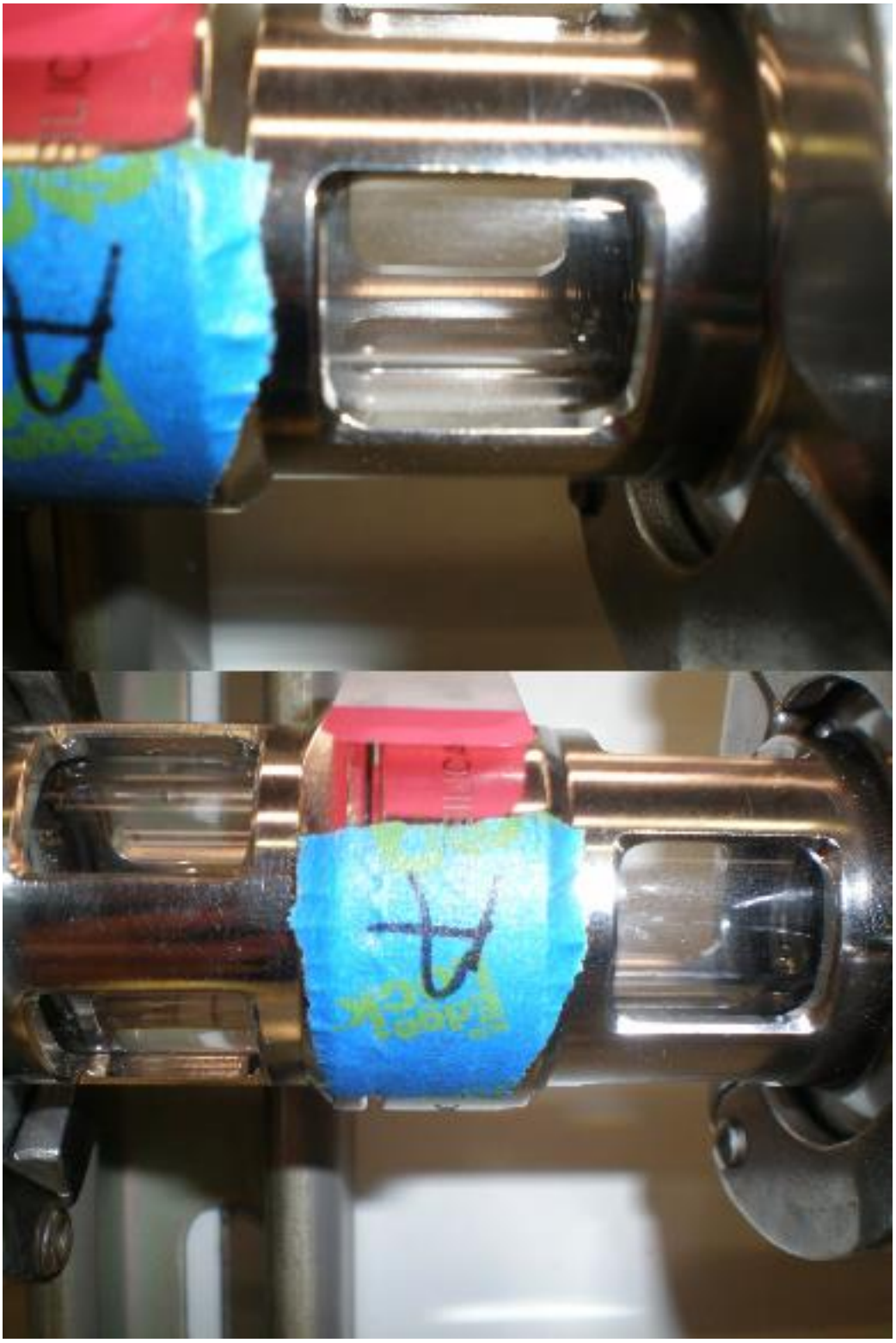

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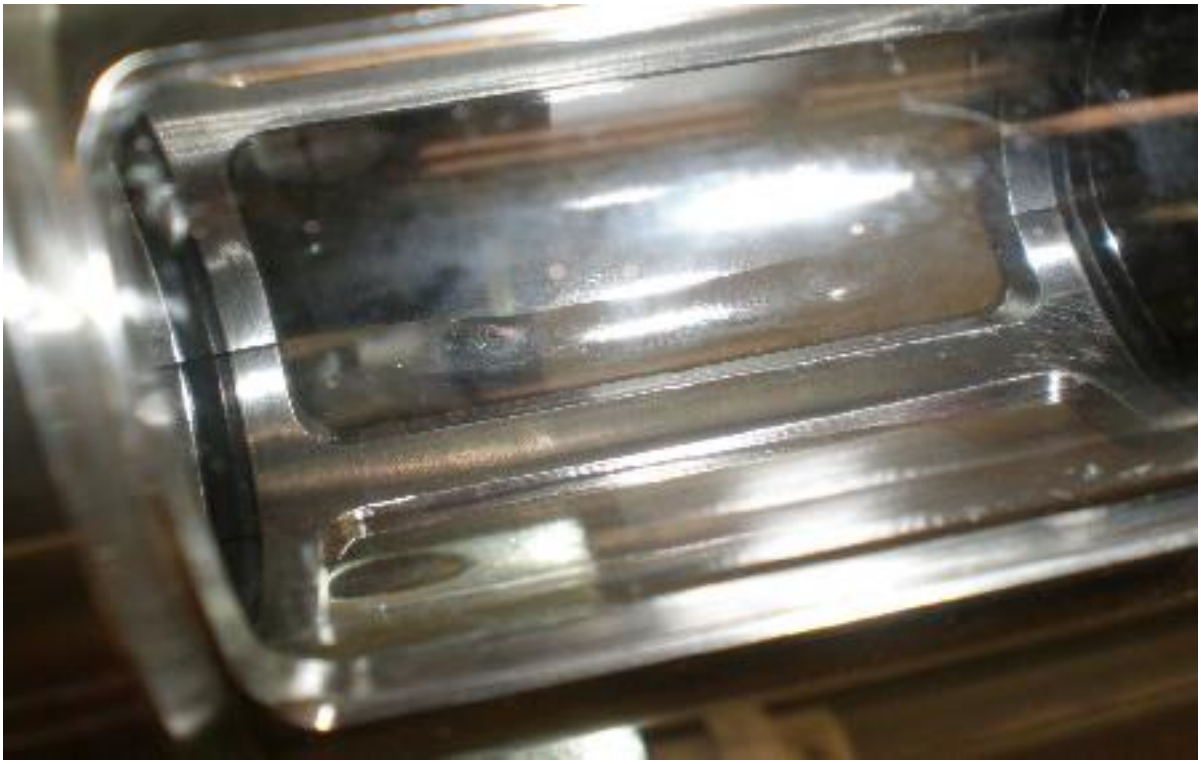

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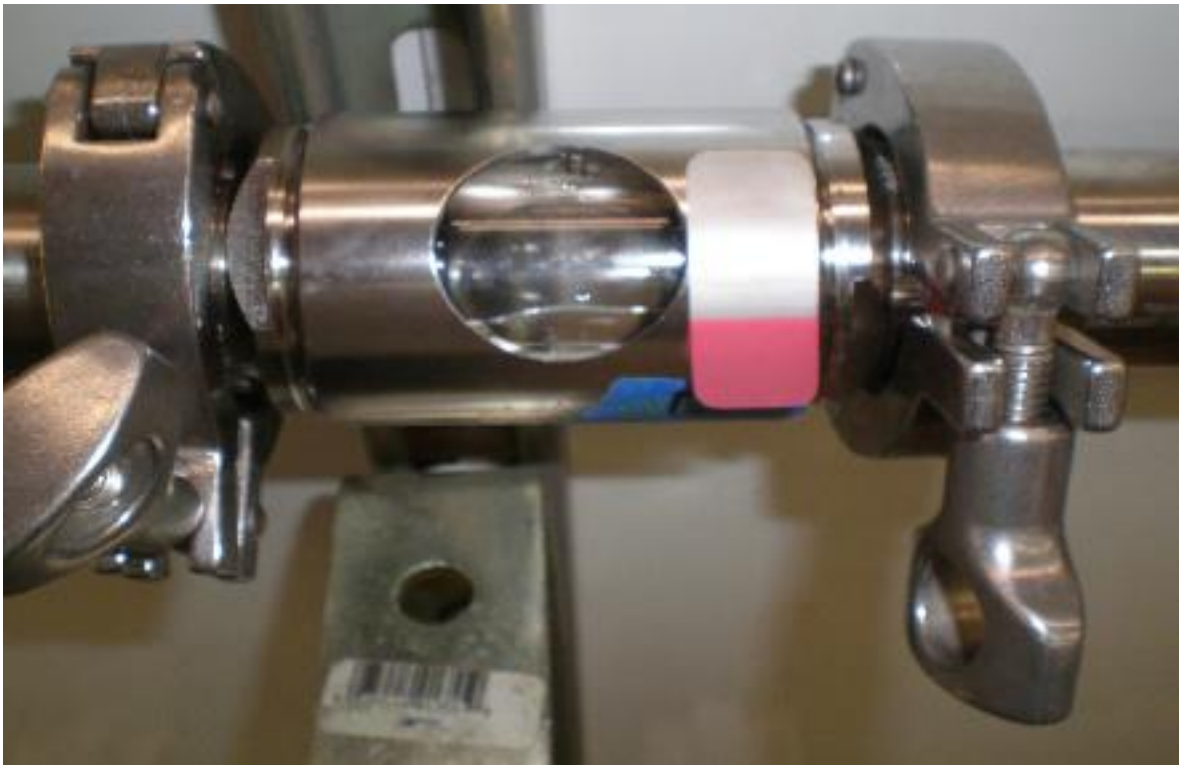

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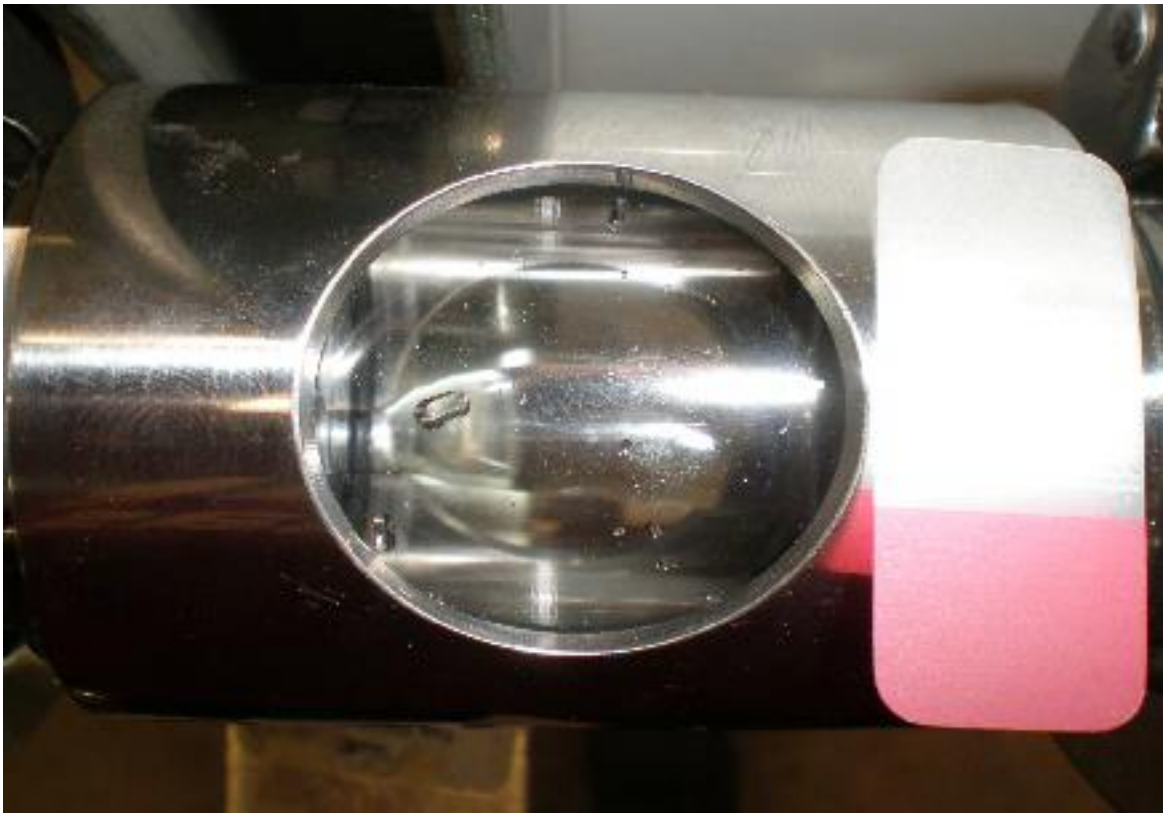

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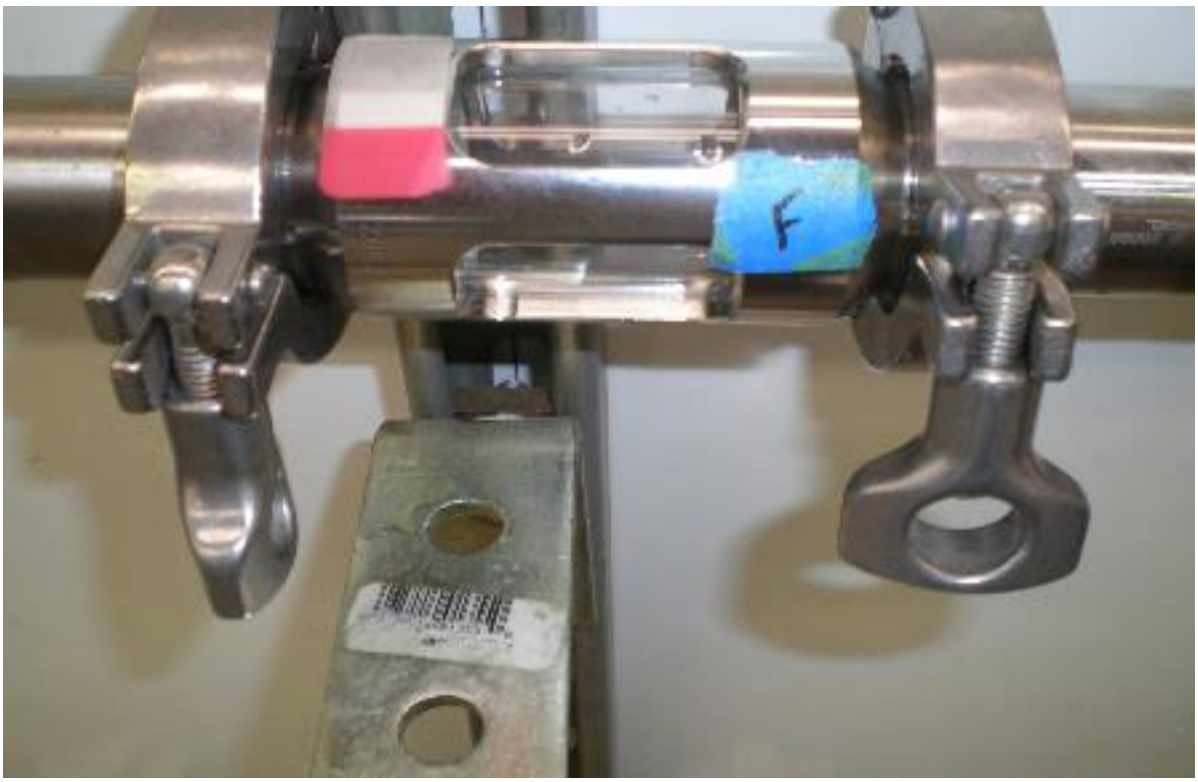
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Test- Left Side of Line- 1/4” Slope

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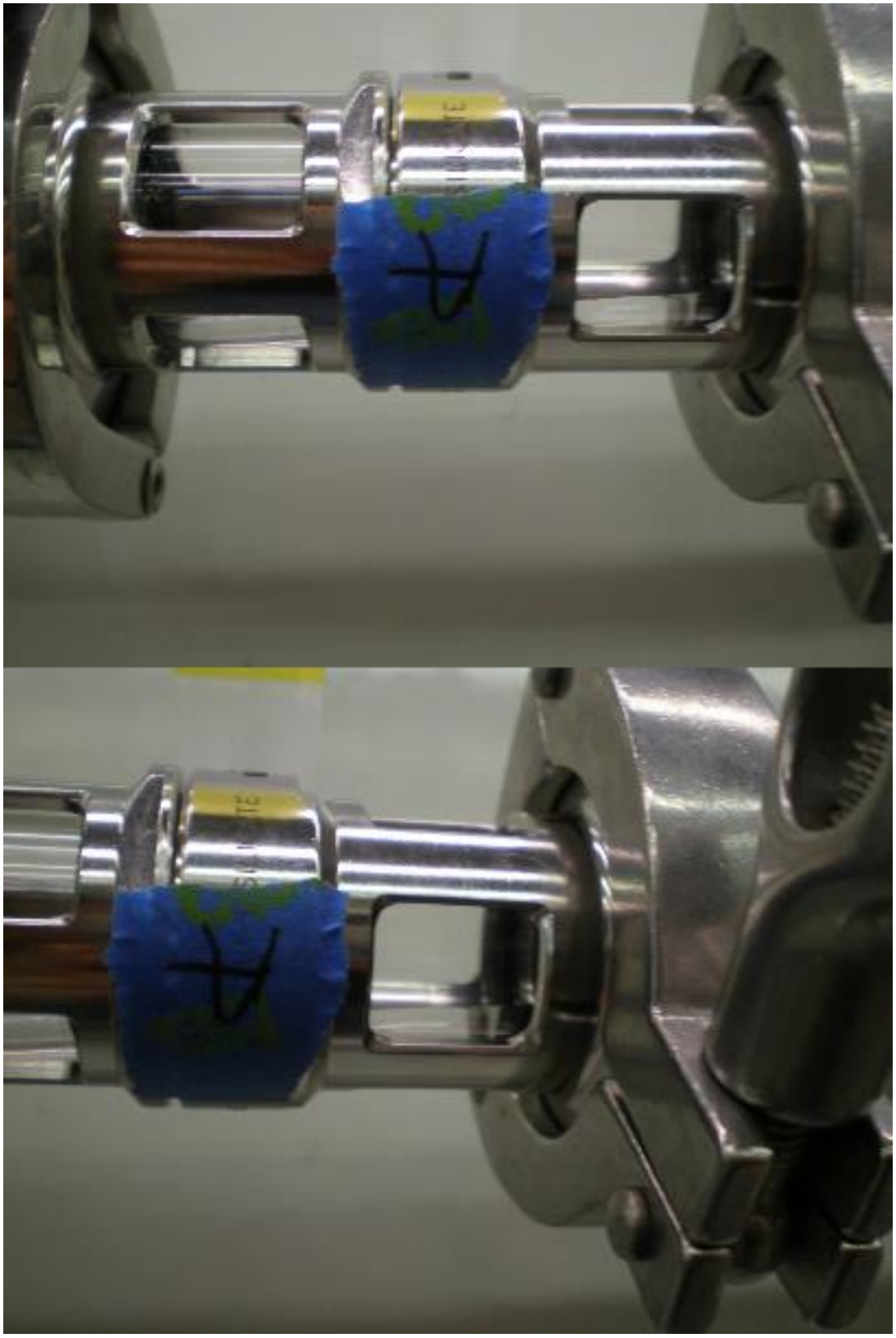

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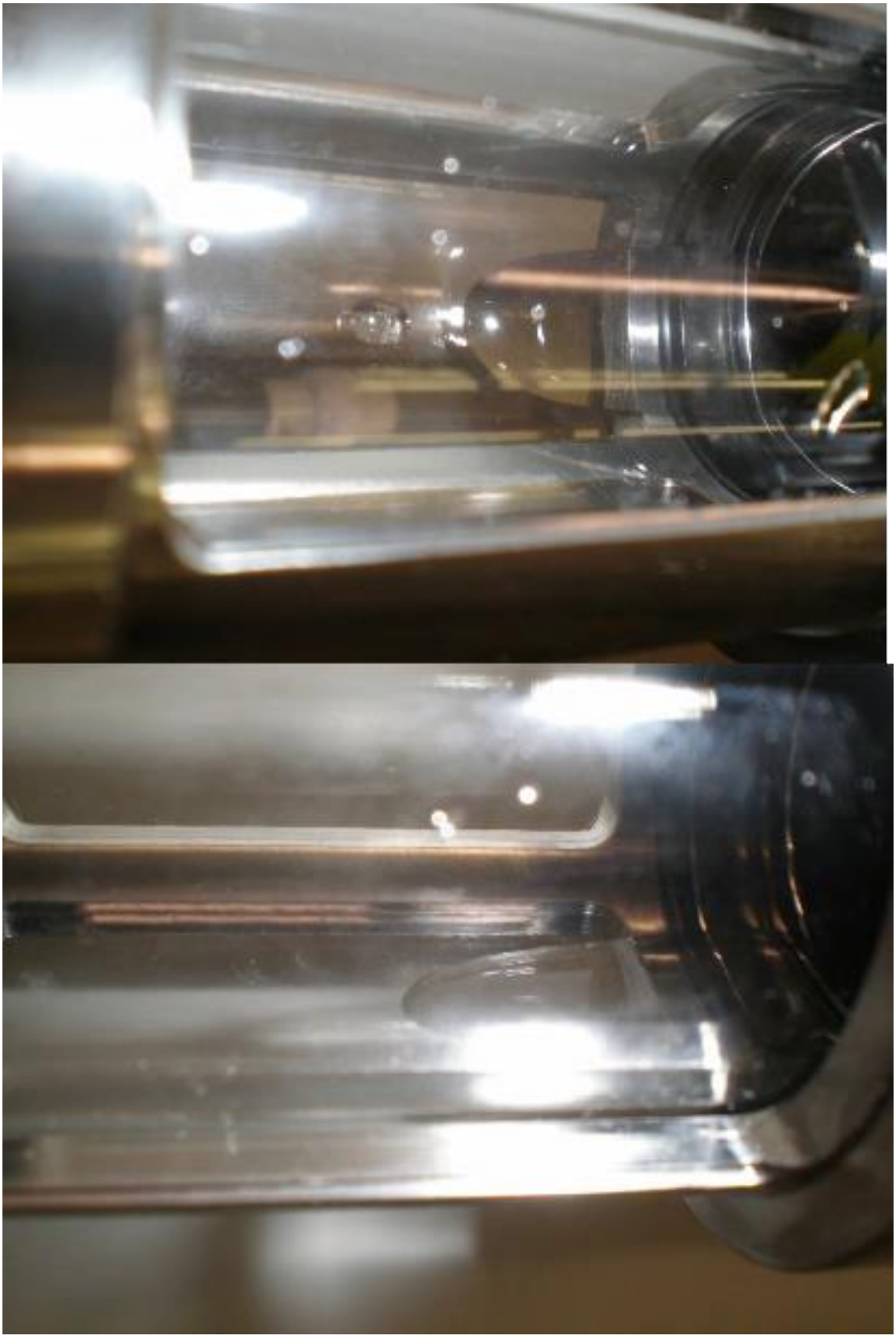

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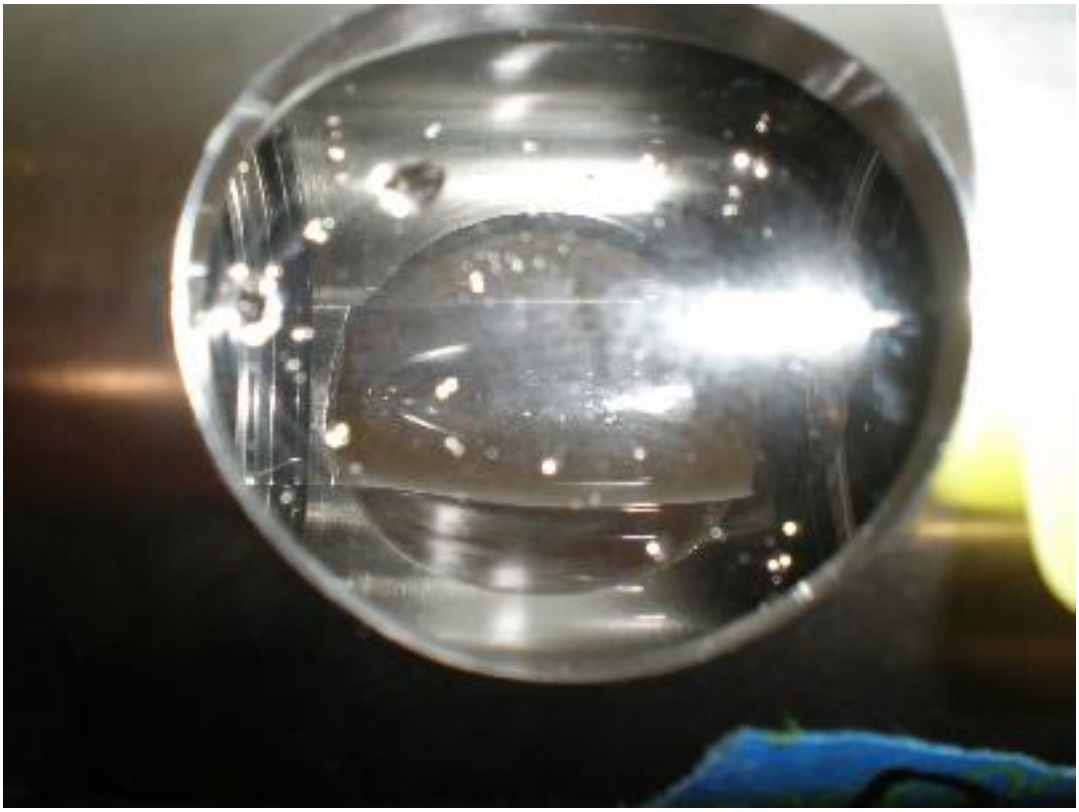

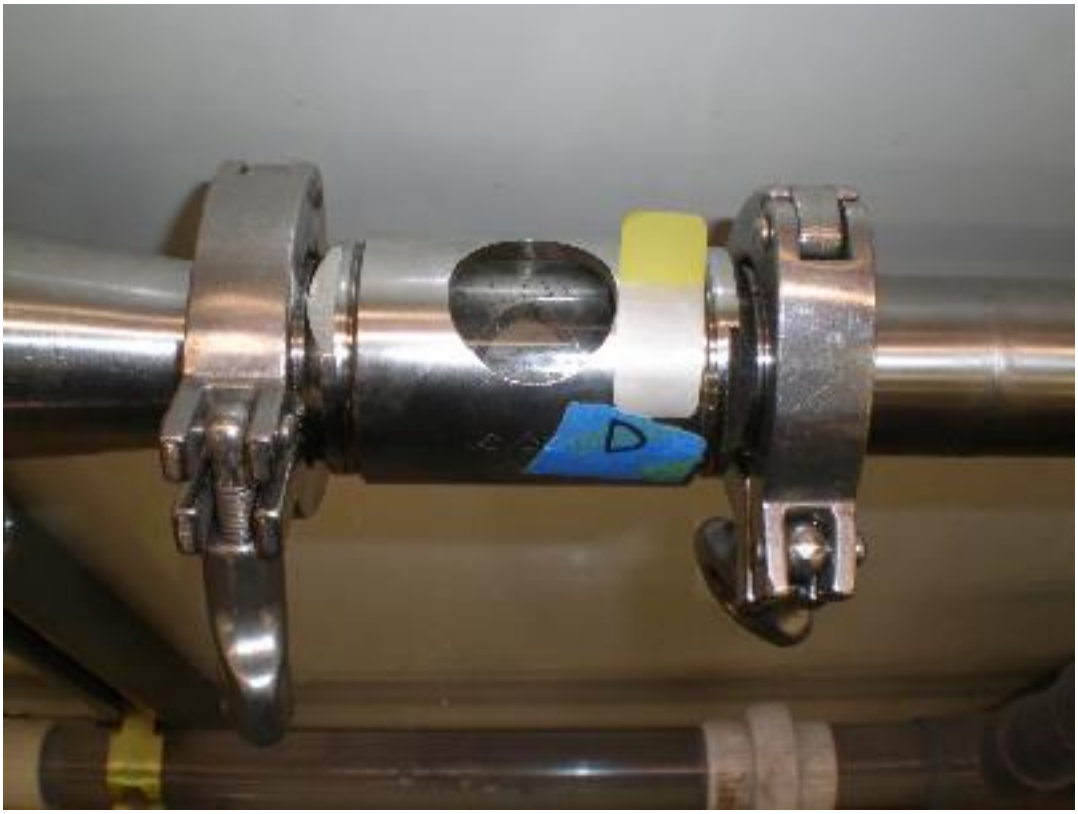

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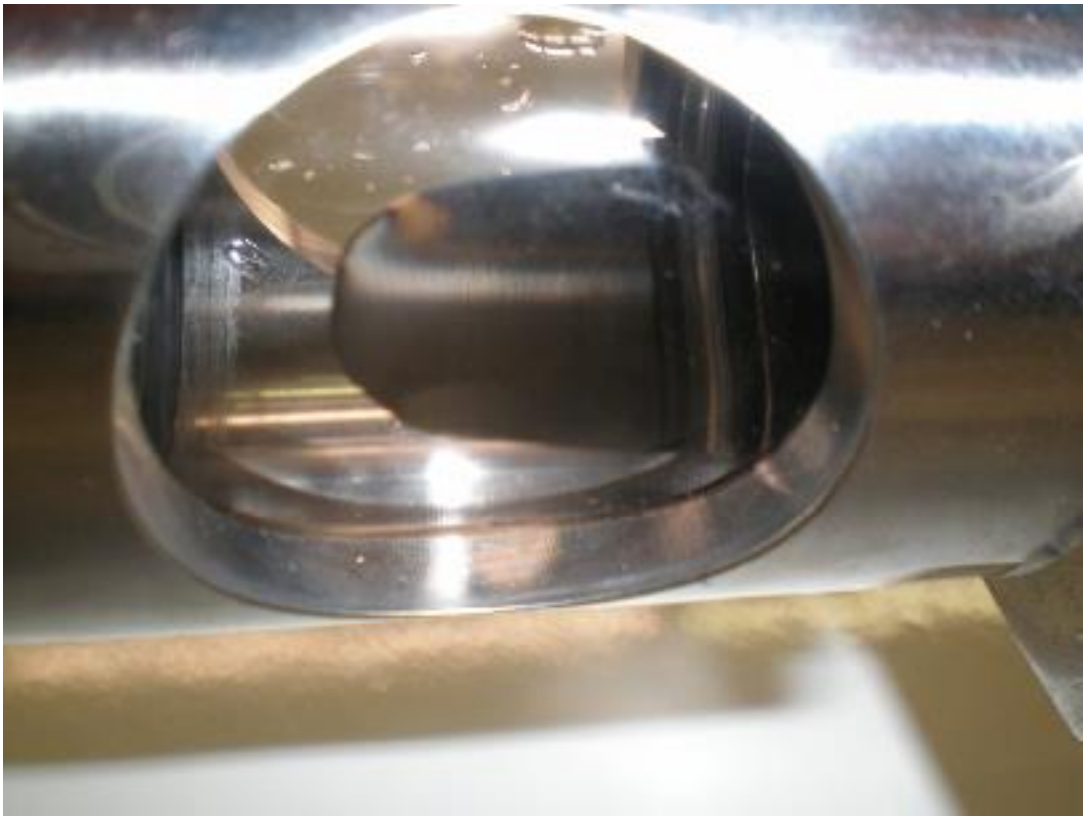

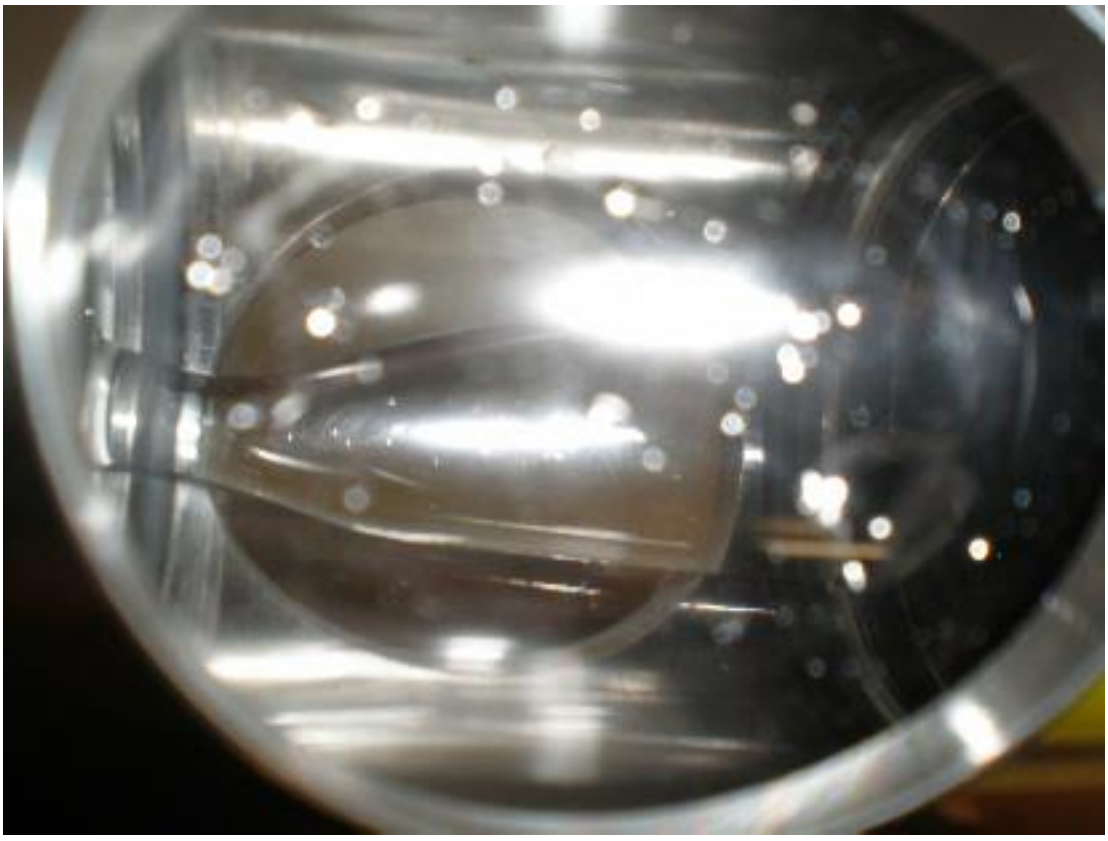

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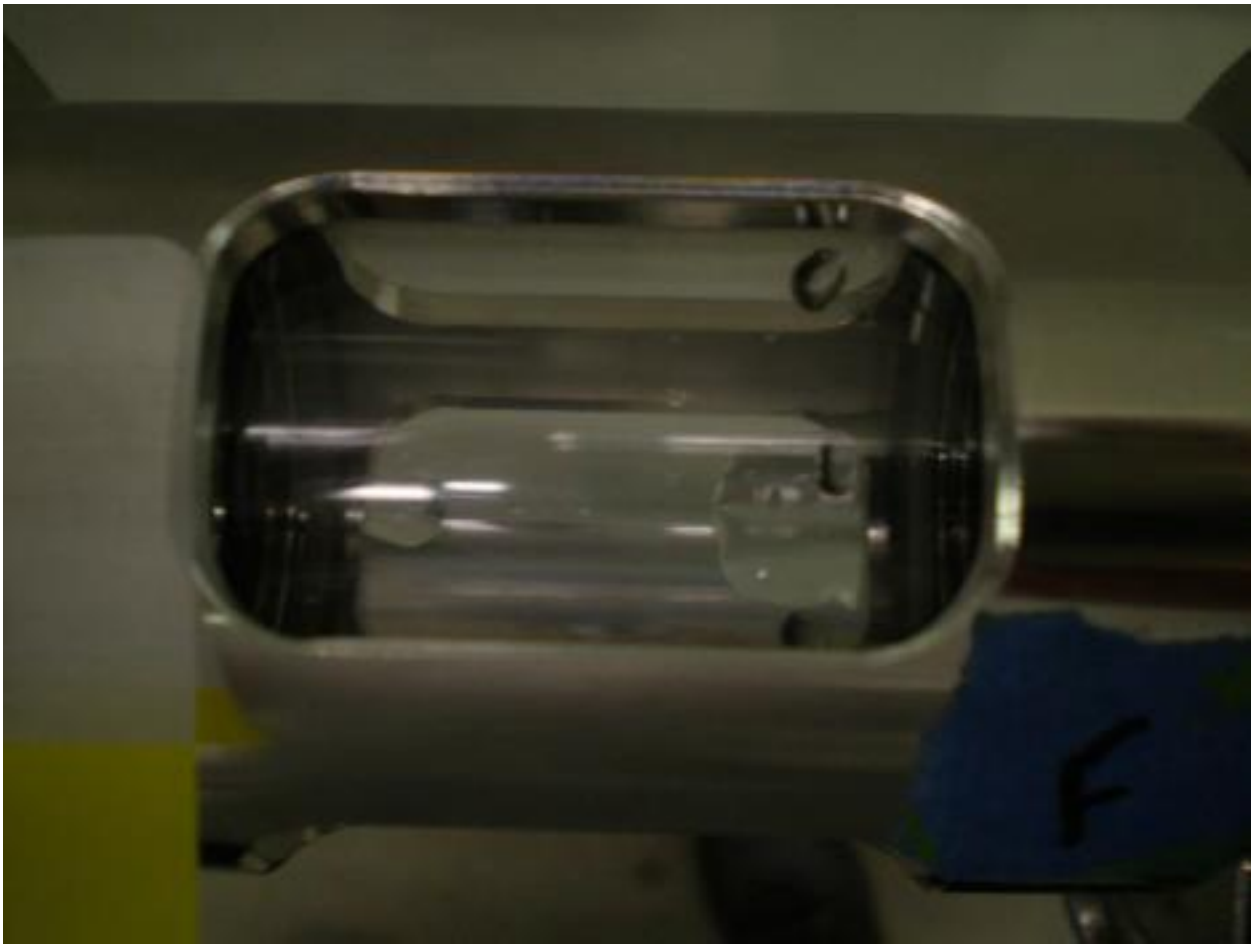

Level used to measure slope

Showing laser on the front of the Pipe

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