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Mechanical & Materials Engineering Division
October 10, 2007

Mr. Brian Herbst
AFL Telecommunications
150 Ridgeview Circle
Duncan, SC 29334

Subject: "External Hydrostatic Pressure Tests of Fiber Optic Tube Assembly"

Reference: Southwest Research Institute (SwRI®) Project No. 18.18072.01.348
AFL Telecommunications Purchase Order No. 147664

Dear Mr. Herbst:

This letter is to document the external hydrostatic pressure testing conducted at Southwest Research Institute on an AFL Telecommunications singlemode optical fiber that was clad in a stainless steel tube. The fiber optic cable, which was spun onto a spool for the tests, consisted of approximately 1.5 km of 1.17 mm, 304 stainless steel tube with two optical fibers inside the steel tubing. The tests were performed on September 27, 2007.

The external hydrostatic pressure testing was performed in SwRI's 30-inch I.D., 10,000 psig test chamber using fresh water at ambient temperature as the test medium. A Hardy Instruments Model HI2151WC digital pressure indicator and a Dynisco Model G831-300-15M pressure transducer were used to monitor the test chamber pressure. Prior to testing, all pressure measuring instrumentation was calibrated on a SI Barnet dead weight tester which has calibrations traceable to the National Institute of Standards and Technology (NIST). A Soltec Model 1243 chart recorder was used to produce a permanent record of the test pressure versus time. A copy of the recording is enclosed with this report.

Prior to performing the pressure tests, the fiber optic cables were molded onto an SwRI fabricated high-pressure penetrator (Figure 1). The cable penetrator was used for the purpose of penetrating the optical fibers through the test chamber lid and facilitate the performance of optical measurements on the cable assembly while at test depth. The tubing was not penetrated through the lid and was left open along with the opposite end of the fiber/tube assembly to the test chamber water. Once the molded feed-thru was installed, the assembly was secured in the test chamber and made ready for testing (Figures 2 and 3).

The test consisted of subjecting the spool of optical fiber/tube to one (1) external hydrostatic pressure cycle to 6,000 +10/-0 psig. This maximum test pressure was maintained for a period of six (6) hours. Attenuation measurements were performed at each 1,000 psig increment during pressurization, at 1-hour intervals during the six-hour hold period at test pressure, and at 1,000 psig decrements during depressurization.



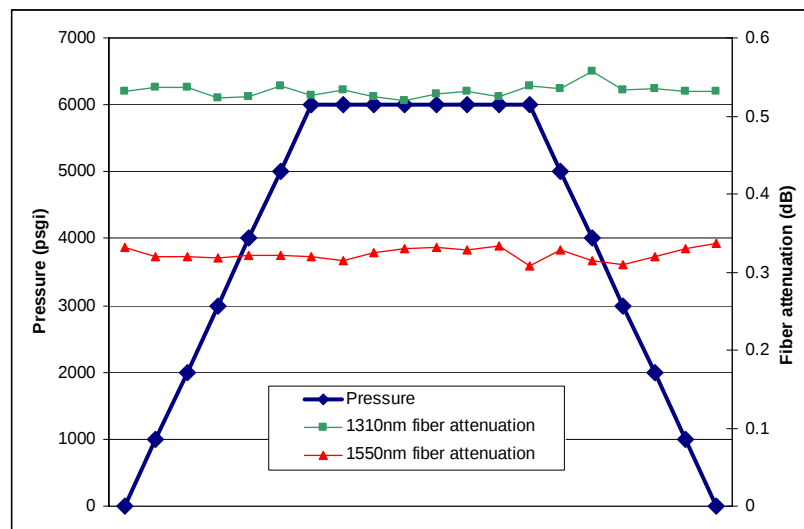
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The pressurization and depressurization rates for the tests were approximately 100 psig per minute in accordance with AFL test procedures. At the conclusion of the six hour hold period at maximum test pressure, the test pressure in the chamber was reduced to 0 psig.

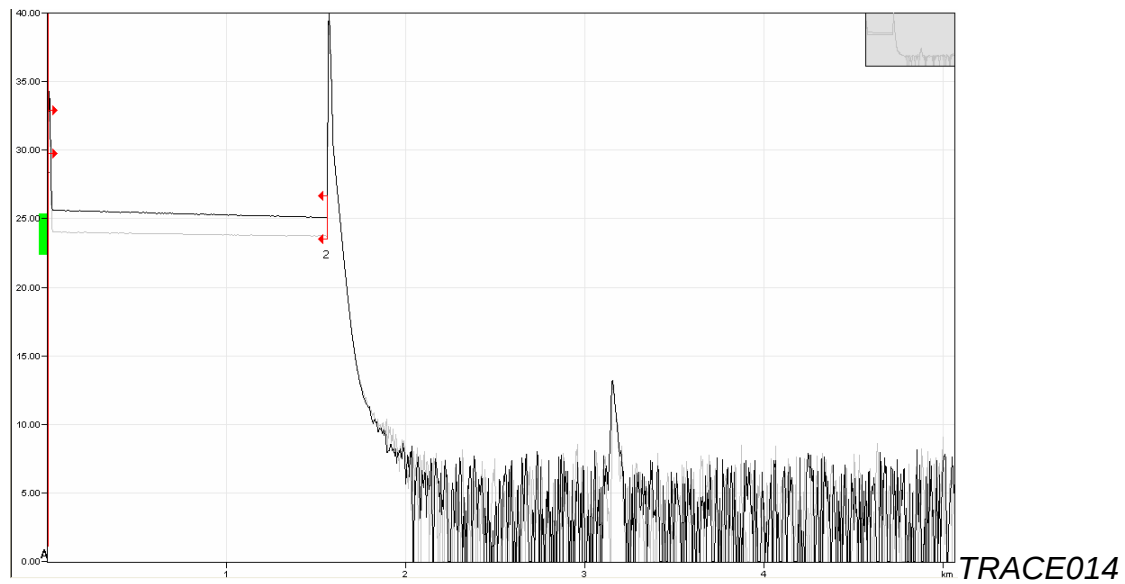
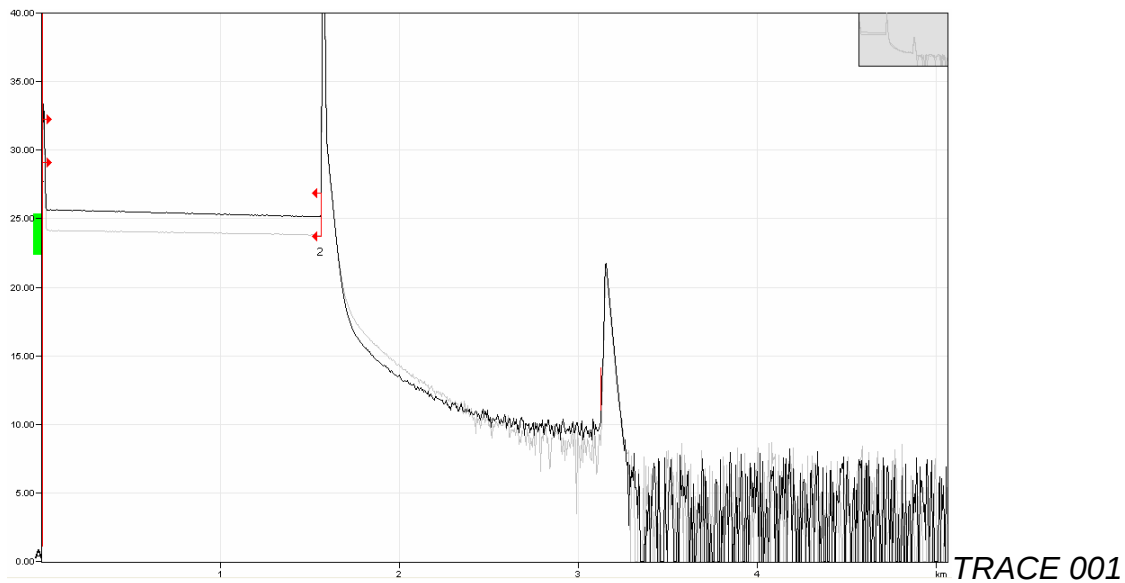
Fiber Optic Pressure Testing Results

The measurements on the optical fiber were conducted using an EXFO Model FTB-100B Optical Time Domain Reflectometer (OTDR). This instrument measures the optical attenuation in an optical fiber, measuring reflections from scattering, bends, breaks or endfaces. It can be used with singlemode or multimode fiber and measures at multiple wavelengths.

The OTDR was connected to an optical fiber, and measurements were recorded. Measurements were recorded at each pressure interval (every 1,000 psig) while the pressure was increased to 6,000 psig, then once per hour while the pressure was maintained for six hours. As pressure in the chamber was decreased, measurements were recorded at every 1,000 psig until the pressure in the test chamber was at 0 psig. The attenuation measurements for the fibers are shown in the graphs included in this report. Page 3 of this report shows two data captures from the OTDR screen showing the loss trace. These traces show the distance along the fiber where an event occurs and the measured loss over a given section. Between points 1 and 2 marked with the red arrows, the loss gradually increases. This is the fiber. Then the spike indicates reflection from the end of the fiber which the instrument measured to be at about 1.56 km. A second spike at exactly twice this distance is simply an echo from the back reflection bouncing back from the first face of the fiber.



Plot of the measured fiber attenuation over time during the pressure testing with the vessel pressure for each measurement shown in the thick blue line.



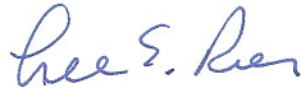
OTDR traces for the optical fiber at 1,310nm (dark line) and 1,550nm (lighter line). The top trace (TRACE 001) is at the starting time with no pressure applied while the bottom trace (TRACE 014) is after six hours at 6,000 psig.

The first OTDR trace was taken before the test began (point 1), and the second trace is from the last measurement at 6,000 psig (point 15). The dark line is 1,310nm, and the lighter line is 1,550nm. As seen from the plot on the previous page, there is very little effect on attenuation of the fibers with the increases in pressure. The observed fluctuations may simply be system noise. No extra loss locations were seen in the OTDR traces.

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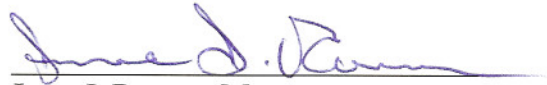
SwRI appreciates the opportunity to provide this testing service and if you have any questions or if we may be of further assistance in the future, please do not hesitate to call.

Sincerely,



Lee E. Ries
Principal Engineering Technologist

Reviewed and Approved by:



Jesse I. Ramon, Manager
Test and Evaluation Section

C:\Documents and Settings\aschutte\My Documents\Ries\18072.348.RPT.doc/as

Enclosures

cc: Record Copy B
A. Schutte

END TEST

6:37 P

10:22 A



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AFL Telecommunications
External Hydro Test
1 ea. 1.5 km Multimode Fiber in SS Tube
Test Date: 9/27/07
SwRI Project No. 18.18072.01.348

SCALE: 0-10,000 PSI (Kb)
CHART SPEED 10 MM/Hr

5:18 P 6006 PSI

4:18 P 6004 PSI

3:17 P 6005 PSI

2:21 P 6006 PSI

1:17 P 6004 PSI

12:17 P 6006 PSI

11:27 A 6008 PSI

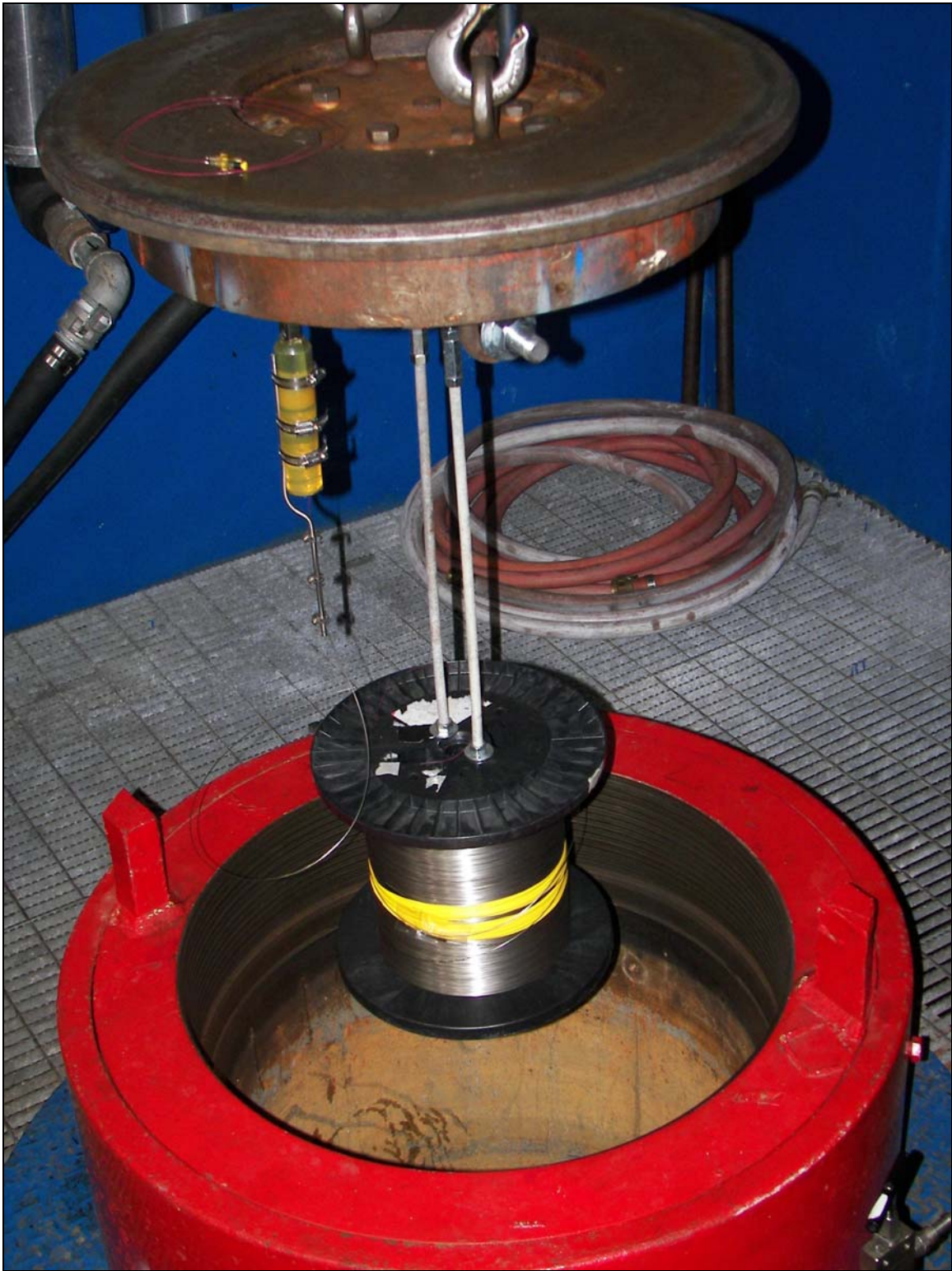


Figure 1.

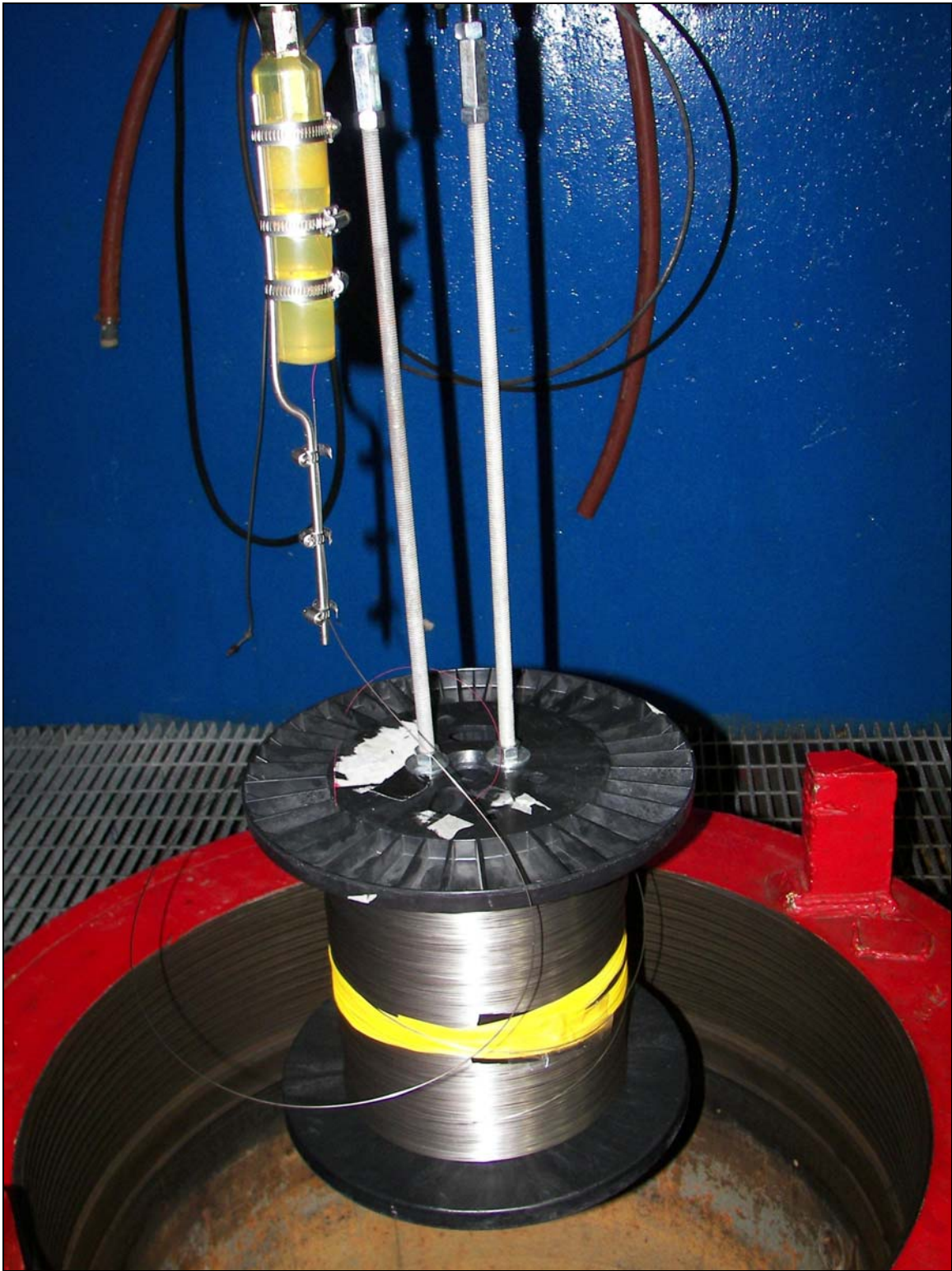


Figure 2.

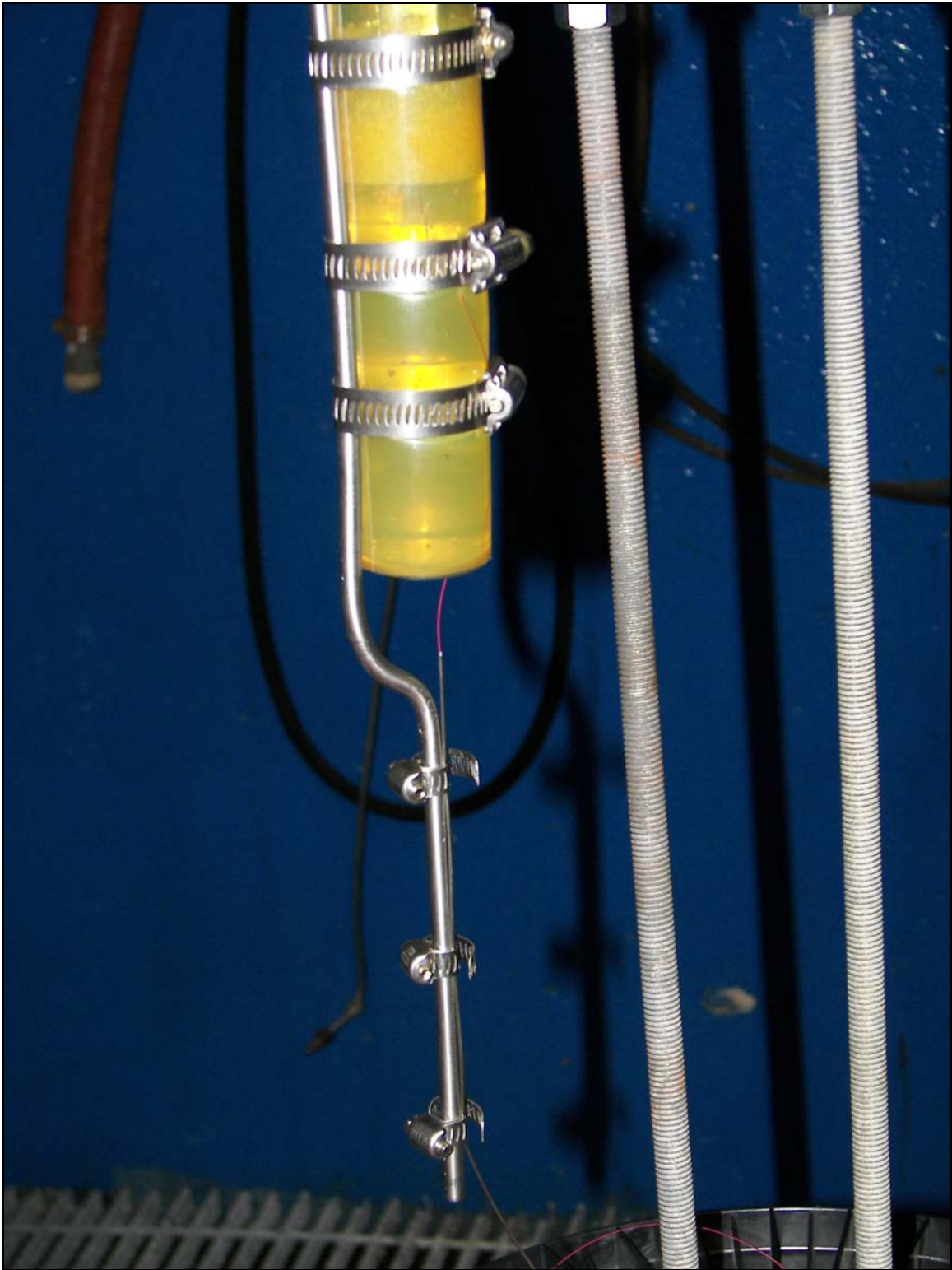


Figure 3.