Subject: Fwd: Fwd: Results of electrical test of ~9km A301592 3-conductor sea cable on winch drum on dock Dec 12, 2017
From: Rick Trask <rtrask@whoi.edu>
Date: 12/26/2017 10:32 AM
To: cgriner@whoi.edu
CC: Ruthanne Molyneaux <rmolyneaux@whoi.edu>, Andrea M Harvey <aharvey@whoi.edu>

Chris

This is the evaluation that Marshall Swartz conducted that I spoke of during our meeting last week. I believe it is of NSF-05-C128. The reel was on the dock, had come off the Knorr, was still on a DUSH 5 drum and there was talk of it going to the ATLANTIS as a spare wire. There is a picture of the reel at the end. If you agree, this email should be uploaded into that reel's database.

Rick

-------- Forwarded Message --------
Subject: Fwd: Results of electrical test of ~9km A301592 3-conductor sea cable on winch drum on dock Dec 12, 2017
Date: Tue, 12 Dec 2017 20:09:31 -0500
From: Marshall Swartz <mswartz@whoi.edu>
To: Rick Trask <rtrask@whoi.edu>, Barbara Callahan <bcallahan@whoi.edu>
CC: Marshall Swartz <mswartz@whoi.edu>

FYI- Dutch may be sending this your way...
Marshall

---------- Forwarded message ----------
From: **Marshall Swartz** <mswartz@whoi.edu>
Date: Tue, Dec 12, 2017 at 8:08 PM
Subject: Results of electrical test of ~9km A301592 3-conductor sea cable on winch drum on dock Dec 12, 2017
To: Mike Gagne <mgagne@whoi.edu>, Dutch Wegman <dwegman@whoi.edu>
Cc: Marshall Swartz <mswartz@whoi.edu>

Mike and Dutch,

At Mike's request, I checked the electrical condition of a used 3-conductor Rochester A301592 sea cable on the drum at the west side of the dock today, to evaluate if the wire could be reliably used again.

Mike provided two CFL535 Cable Fault Locator instruments and one AEMC1060 insulation tester from his shop. I conducted the tests outside on the dock today in high humidity conditions, with reliable results.

The cable passed continuity and insulation tests at 500VDC, and meets Rochester electrical specifications for new A301592 cable.

I found no markings or nameplate on the drum. See the photo below to identify the drum. Straps securing the drum were marked "Knorr".

I do not know the length of this cable, but was told it is about 9km. During test preparation, the axle end cable marker tape was exposed and read "000046.0"

All three electrical conductors have end-to-end resistance of about 246 ohms at 5 deg C, as expected for an approximately 9km cable.

Each conductor passed 500VDC one minute insulation tests to armor and to adjacent conductors with all readings in excess of 150Gohms.

At the conclusion of the tests, the wire ends were carefully taped to exclude moisture, and secured to the drum to permit local shipment. The straps securing the drum to the pallet were not touched.

Mike also requested that I use both CFL535 Cable Fault Locator instruments from his shop to determine if they provided different results in the same test scenario. I could not find any meaningful difference between the two instrument results.

This testing was requested by Mike on Monday and completed today, December 12, 2017 by me. Thanks for this opportunity to assist you.

Observations on the wire:

- The wire appeared to be properly level wound, and a cursory check did not find high or loose armor strands on the top lay of cable.
- The top lay of the cable has surface rusting as expected for cable exposed to weather on a ship for years.
- None of the bare copper lead of the conductors on either end had discoloration evidence of sea water intrusion.
- The outer teflon and the inner conductor XPE insulation exposed to perform the test appears in good shape.
- The existing GDE1106 Guy-Grip dead end termination has not been removed or adjusted, and can be pull-tested, but is applied to rusted outer jacket of the cable and may not perform at rating.

Preparation:
The electrical splice and Mecca single conductor pigtail connectors at each end were cut off and discarded. The Mecca pigtail and connectors all had significant oxidation and UV exposure damage and were not suitable for reuse. The neoprene lost the pliability characteristics required for a proper water seal.
Each lead of the inner conductors were removed from the outer black teflon insulating jacket, then stripped to bare copper for the instrument test lead alligator clip connection.
3 strands of the galvanized steel inner conductor armor were cleaned and used as the connection point for test lead connection. Care must be taken to assure alligator clip bite into the armor.

Instruments used for testing:
CFL535F Cable Fault Locator, s/n "6411-012/060906/1607". From Marine Electronics shop.
CFL535F Cable Fault Locator, marked "KNORR" on top side of front panel. s/n not readily readable. From Marine Electronics shop.
AEMC 1060 insulation resistance tester, s/n "105461 DA DV" From Marine Electronics shop.
Fluke 87V from Swartz lab.

Testing process and results:
1. Fluke 87V DVM, lead to armor DC mV residual voltage test, lead-to-lead and lead-to-armor: **PASS.**
No conductor had a residual voltage in excess of 2 mVDC to another conductor or to ground. Indicates residual voltages will not affect high resistance readings.

2..Fluke 87V lead-to-lead and lead-to-armor insulation test: **PASS.**
Insulation on all conductors exceeds 60 Mohms at DVM voltage (approx 3VDC).
All conductor and armor combinations were in excess of 60 Mohms, a likely indicator that insulation system is good.

3. Fluke 87V lead end-to-end 2-terminal resistance test: **PASS.**
All conductors exhibited end-to-end resistance close to manufacturer specification for the expected 9km length at approx 3deg C.
Mfgr spec: 30.9 ohms per km at 20 deg C.
Black-black: 245.2 ohms.
Red-red: 247.1 ohms.
White-white: 245.2 ohms.
Armor-armor: 1.6 ohms. Expect <2 ohms when wound on drum.

4. AEMC1060 insulation resistance test at 500VDC for 60 seconds for each lead-to-lead and lead-to-armor pair at 500VDC: **PASS.**
Mfgr spec: 3.0 Gohms x km.
Black-armor:307 Gohms. DAR 4.47, 0.87 uF..
Red-armor: 225 Gohms. DAR 2.73, 0.66 uF.
White-armor:194 Gohms. DAR 1.57, 0.85 uF
Black-red: 265 Gohms.
Black-white: 218 Gohms.
Red-white: 244 Gohms.
Note: conditions humidity > 90%, air temp < 3C, windy and rainy, wire ends under cover and dry..

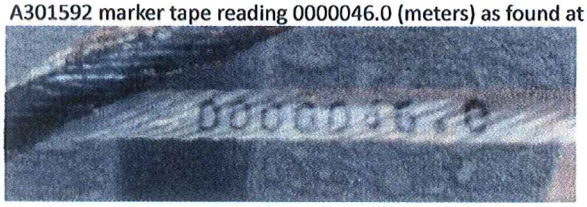
5. CFL535 Cable Fault Locator TDR impedance reflectance test, lead to armor: **PASS.**
Both CFL535 instruments were used, and both showed the same behavior on any lead pair chosen.
Neither instrument was able to automatically resolve an open or shorted circuit pair at the far end in automatic mode..The CFL535 improperly locked into the transmitted pulse despite adjustment of the transmit null front panel adjustment. Note that the internal settings of the CFL535 can be changed to adjust pulse width at longer ranges, but this was considered unnecessary given the insulation test results.
Since the cable was expected to be about 9km long, the CFL535 range had to be set manually to 16km, and then the velocity factor was adjusted while alternately shorting and opening the far end circuit.
Setting the CFL535 cursor to the start of first repeatable and reliable inflection point of the trace yielded 9.2km at Vf = 0.519.
Note: The CFL535 did not display any reliable indication of an impedance fault, either high or low, close to either tested end of any lead pair.

But since the gain had to be quite high (> 56dB) at the 16km range, manual determination of the inflection point was hard to properly determine from background trace noise.
The CFL535 results from either instrument show no reliable evidence of an impedance fault on the cable to ground along the span. This is confirmed by the Fluke 87V testing. See photo below.

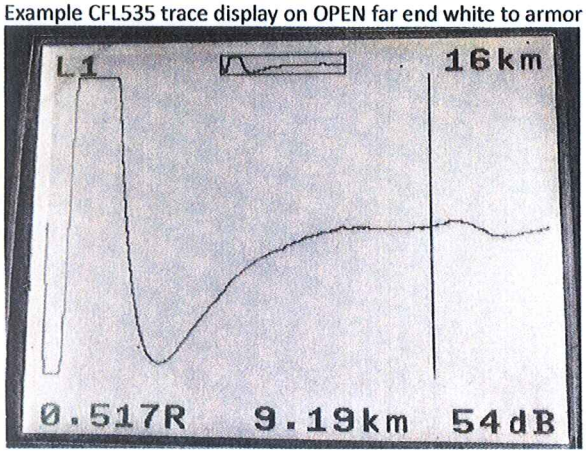
Conclusions:
1. No electrical issue with end-to-end continuity or insulation system was found, and cable appears to meet manufacturer's electrical specifications at 500VDC.
2. The two CFL535 Cable Fault Locator instruments could not reliably determine the end of the cable in automatic determination mode with either a temporary short or open condition.. Manual over-ride of the range mode had to be used. See the example trace photos below.
3. The two CFL535 Cable Fault Locator instruments were indistinguishable in operation with these test conditions.
4. The use of a good quality (4.5 digit) DVM and a high range insulation tester were sufficient to qualify the cable in this situation.
5. After removal of the guy-grip termination, the armor can be unwound to expose the termination end cable marker tape to allow an exact determination of the cable length as found on the drum.
6. This cable appears electrically in "used but good" condition and could be considered to return to service as a used wire. I would recommend regular insulation testing for the remaining life.

Photos:
View of A301592 cable spooled on Markey drum at West end of WHOI dock 12/12/2017.

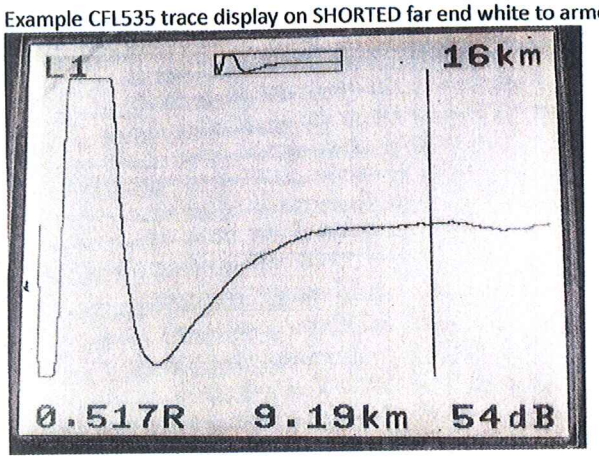
A301592 marker tape reading 0000046.0 (meters) as found at axle end fly lead from drum:



Example CFL535 trace display on OPEN far end white to armor lead pair with rising inflection at cursor:



Example CFL535 trace display on SHORTED far end white to armor lead pair with flat inflection at cursor:



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