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Locating Electrical Leaks (Part 1)

Electrical leaks, or the break down of the insulation of the conductor, are typically caused by one of the following reasons:

- Physical Damage: The cable, jumped the sheave wheel, over-run in the hole, drum crush, kick back from a large gun, cut-in while spooling cable, or other accidental mechanical damage.
- Excessive Temperature: Operating the cable at bottom hole temperatures in excess of the maximum temperature rating of the cable. High tensions at maximum temperature.
- Excessive Tension: Repeated tensions over 60% of rated breaking strength or a little as one pull in excess of 75% of rated strength of the cable.
- Manufacturing Defects: Inner armor coverage less than 97%, Non uniform spacing of inner armor wires, eccentricity in conductor insulation, Crossed inner armor wires, Tape lap joints or string filler knots in multiconductor cable.

There are basically three different types of electrical leaks:

- "Dead short": The resistance , or leak, is less than 100 Ohms.
- Hi resistance: The leak is as high as 20 Meg-Ohms.
- Intermittent leak: This is the worst type as the leak at times disappears.
- Wet leak: Any of the above 3 types of leaks can have moisture present which can complicate the location of the leak. Moisture in the leak can generate a small voltage between the copper conductor and the zinc of the armor wire, which will give misleading resistance measurements.

The fastest way of locating an electrical leak is to "burn it out" with a high voltage, high current source* and in doing this you dry the leak and reduce it to a " dead short". There are several methods of easily locating a " dead short". When it is known that the cable has been abused in some way, tension or temperature, then burning out the leak is the best procedures. If, however you have a fairly new cable and a factory defect is suspected, the burn out method should not be used as it completely destroys the area around the leak and the exact cause of the leak can not be determined. There are methods of locating leaks within a few inches without first burning out the leak as will be covered in later technical bulletins.

Part-1, Method for locating a "dead short" leak. A dead short leak, as described above, is when the copper conductor is in direct contact with the armor or the resistance between the conductor and armor is less than 100 ohms. The only instrument required is an accurate digital ohmmeter that reads to at least 0.1 Ohm. Before any leak location process is started be sure that both ends of the cable conductor are completely disconnected from any tools, collector, etc. and clean!

After both ends of the conductor are cleaned, using the digital Ohmmeter, measure and record, the following resistances.

- R: Total conductor resistance, end to end, Ohms.
- Rt: Resistance between conductor & armor measured at the Truck end, Ohms.
- Rw: Resistance between conductor & armor measured at the whip end, Ohms.
- L: The total length of the cable, feet.

To be sure your problem can be classified as a "dead short", make the following calculation:
((Rw + Rt) - R) < 300 Ohms

If the this calculation is greater than 300 Ohms, you do not have a "dead short" and you should use another method of locating the leak, (Part 2 & 3), or "burn out" the leak to obtain a more direct short. If the above calculation results with a value less than 300 Ohms then the leak location can be calculated as follows:

- Lw: Distance of the leak from the whip end of the cable, feet.
- Lt: Distance of the leak from the truck end of the cable, feet.

$$Lw = [R + Rw - Rt] \times [L / 2R]$$
$$Lt = [R + Rt - Rw] \times [L / 2R]$$

Example:

Cable length:
L = 20,500 feet
R = 220.5 Ohms
Rw = 165.0 Ohms
Rt = 325.5 Ohms

Leak Location:

Lw = [220.5 + 165.0 – 325.5] x [20,500 / 2x220.5] = 2,789 feet from whip end
Lt = [220.5 + 325.5 – 165.0] x [20,500 / 2x220.5] = 17,711 feet from truck end

Methods for locating high resistance electrical leaks and eliminating the effects of a wet leak will be covered in later Technical Bulletins.

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