Meggar Testing
Excerpt
from
PRYSMIAN'S
WIRE AND CABLE ENGINEERING GUIDE

(FOR INFORMATIONAL PURPOSES ONLY)

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MEGOHMETER TESTING

Megohmeter testing can be applied as a destructive (Type 1) test or a diagnostic (Type 2) test depending on factors such as test duration and test voltage. Typical application of a megger test determines the insulation resistance of the test cable. The resistance measurement is used to determine whether or not the circuit will operate without excessive leakage current through the insulation when energized. Measured values can be impacted by certain external factors (temperature, moisture, etc.), which may result in questionable readings, even when evaluated on a satisfactory length of cable.

The megger test is performed by applying an elevated DC voltage to the conductor and measuring the current flow to a ground reference. With the known voltage and measured current, an insulation resistance value can be calculated.

It is important to recognize that megger testing *non-shielded* cables may produce marginal results due to the inherent lack of a completely encompassing and uniform ground plane over the dielectric of the cable. The insulation resistance of a single non-shielded cable on a reel can be determined if the end-user has the means of submersing the cable and reel while performing a megger test.

Megger testing non-shielded cables by applying a potential to the 'test cable' and grounding the other cables on the same reel, in the same duct, as well as possibly the duct itself provides a real life example of a megger test that may produce marginal results due to the inherent lack of a completely encompassing ground plane around the test cable.

Additional information on megohmeter testing of insulation resistance can be found by referencing Megger's "A Stitch in Time" *The Complete Guide to Electrical Insulation Testing*.

Proper Setup

- Connected equipment (switches, relays, buswork, transformers, etc.) may have lower IR values than the cable, or may not be capable of withstanding the test voltage applied by the megohmeter and should be disconnected before any testing is performed.
- Ground all conductors, except the one to be tested.
- Connect cable shield to ground; ground any adjacent equipment.
- Ensure adequate clearance of the conductor/terminals to be tested from ground to prevent flash over.
- Leakage current from conductor ends to "ground", flowing over wet or dirty wire and cable ends, will cause low IR readings. Tests should be performed in a dry working area when possible. Cable ends should always be cleaned and dried by wiping them with a cloth that has been moistened with an appropriate solvent. Avoid using solvents with 1,1,1 – trichloroethane or other hydrocarbons that may damage the cable insulation. Test should be performed as soon as the cable end is clean and dry.
- Corona-proof conductor/terminal ends of cable by sufficiently taping them. If cable is terminated, cover termination with polyethylene bucket or bag.
- Fence conductor/terminal ends for personnel safety.
- Temperature can affect readings. The higher the temperature, the lower the apparent IR and vice versa. The constants given below are for insulation systems at a uniform 15.6°C (60°F). If the total system, or parts of it, is at temperatures that are significantly above or below 15.6°C, a correction factor may have to be applied to determine the "true" IR. However, if the measured IR of the system is equal to, or greater than, the calculated value, a correction to "true" value is probably not needed for practical purposes.

Calculation Procedures

Laboratory Method

The target value of the insulation resistance of a particular cable can be calculated using the following formula:

$$IR = K \cdot \text{Log}_{10} (D/d)$$

IR = Insulation resistance in MΩ•1000 feet at 60°F or MΩ•km at 15.6°C
K = Specific insulation resistance constant in MΩ•1000 feet at 60°F or MΩ•km at 15.6°C (See Value of K in Table 1)
D = Diameter over insulation, mils
d = Diameter under insulation, mils

TABLE 1. Minimum Values of K at 60°F

Insulation Type	K (MΩ • 1000 feet)
Thermoset (Crosslinked) Polyethylene Low Voltage (rated 0 - 2kV) High Voltage (rated > 2kV)	 10,000 20,000
Thermoplastic Polyethylene	50,000
Polyethylene – PVC Composite	30,000
PVC PVC (@75°C)	500 2,000
Ethylene Propylene Rubber Low Voltage (rated 0 - 2kV) High Voltage (rated > 2kV)	 10,000 20,000

NOTES:

- ***This calculation method is based on laboratory testing and may not be applicable to field testing.***
- ***Measured IR is inversely proportional to cable length: a cable of 500 feet will exhibit twice the IR of a 1000 foot length; a 2000 feet length will have half the IR of a 1000 feet length.***

Cable Testing

Please recognize that this document is only intended to provide general information about Megohmeter testing. For further information about cable testing, please contact Prysmian's Application Engineering department or a reputable cable testing company.

The interpretation of cable testing results is the key to properly assess the characteristics of a cable!

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