



COMMENTS ON ADDITIONAL COMMISSIONING AND MAINTENANCE TESTS

GENERAL

Olex New Zealand Limited considers the tests set out in their Technical Informatives, 21-61-011 for "Tests After Installation on XLPE Medium Voltage Cables", & 21-61-016, for "Maintenance Tests on Polymeric Medium Voltage Cables", to be the minimum that should be carried out for commissioning and maintenance purposes. They can be performed by using test instruments generally available in New Zealand.

Other tests may be added but require instruments that are not so commonly available currently in New Zealand. The end user of the cables must determine whether these tests are relevant for them, the frequency to perform them and the additional associated costs to perform them.

Any of the additional tests below may be performed as Commissioning and/or Maintenance Tests. If any of the tests are envisaged as being used as Maintenance Tests, then they should be also performed as a Commissioning Test and the measurements recorded for later comparison. The methods of performing the tests on each installation should also be recorded so that the tests are performed in exactly the same way in the future.

SAFETY REQUIREMENTS

As the voltages used in these tests are potentially lethal, appropriate safety measures must be employed to ensure that the safety of all people involved in the testing process is not compromised.

Cable ends to be isolated shall be disconnected from the supply and protected from contact to supply, or ground, or accidental contact.

Safety measures shall include, and shall not necessarily be limited to, earthing of cable under test prior to and after test voltages are applied, erection of safety barriers with warning signs, and an open communication channel between testing personnel.

The testing guidelines outlined in this document are Olex New Zealand Limited's recommendations only, and Olex New Zealand Limited can not be held responsible for ensuring the safe implementation of these recommendations.



ADDITIONAL TESTS

Additional tests could include the following:-

- Insulation Resistance of Primary Insulation.
- Conductor Resistance.
- Screen Resistance.
- 5 Minute Step Voltage Test.
- Tan Delta Measurement using a VLF AC Voltage Test Set.
- Partial Discharge Test.

COMMENTS BY OLEX NEW ZEALAND ON THE ADDITIONAL TESTS

Insulation Resistance

Most supply authorities would normally perform this test before livening the cables after installation or after any repair work, using an Insulation Resistance Tester with a voltage of up to 5,000 volts DC.

The measured values obtained from an insulation resistance test on installed cables is influenced more by the temperature, humidity and accessories fitted to the cable than by the cable itself.

The Polarisation Index Test is tending to replace this test as the measurement is less affected by climatic conditions.

Conductor Resistance and Screen Resistance

Can be of use to evaluate faulty connections in either the conductors or screen wires and corrosion or mechanical damage to the screen wires.

Normally requires the use of a Kelvin Bridge or a four terminal resistance measuring instrument, capable of measuring down to $1 \times 10^{-7} \Omega$. This type of instrument is now available in New Zealand at moderate cost.

5 Minute Step Voltage Test

This test should use five equal steps up to the maximum test voltage of 2.5 kV for 1.9/3.3 kV cables or 5 kV for cables greater than 1.9/3.3 kV up to 19/33 kV. The total test time is 5 minutes, i.e. one minute per voltage step. This test is becoming increasingly used on cables of 6.35/11 kV and greater.

A Step Voltage Test is useful to identify local weak spots because they react differently as electrical stress is increased.

This test can be carried out automatically with the Megger, BM 25 unit.



The 5 Minute Step Voltage Test should be carried out in the “Guarded Mode”, and guarding should be applied at both ends with a spare core used for the connection lead to the guard at the far end. Any conductor or cable core used as a guard lead must have a resistance to ground of greater than 10 kΩ.

Tan Delta Measurement using a VLF AC Voltage Test Set

Olex New Zealand does not have any direct experience with this type of measurement. We understand from available literature that a VLF AC Voltage Test Set used in conjunction with a Tan Delta Bridge has the ability to detect the overall deterioration of cable insulation, rather than local positions as with a Partial Discharge measurement.

It looks at bulk insulation, so cannot differentiate between lots of small and one big problem.

It is more sensitive to early or small changes in degradation of the insulation than a simple Insulation Resistance or Polarisation Index test.

Tan Delta is easily measured with a VLF AC Test Set as Tan Delta increases with decreasing frequency. It is a good test to use to evaluate water treeing in the insulation.

To our knowledge there are very few of these test sets currently available in New Zealand but this situation is slowly changing.

Olex New Zealand understands that this test can be substituted for the Polarisation Index Test.

AVO NZ can supply test equipment to perform Tan Delta Measurements using a VLF AC Voltage Test Set.

Partial Discharge Test

Partial Discharge tests can be carried out on installed cables by several methods. With cables de-energised and using a VLF AC Voltage Test Set, Off-Line PD Testing can be performed or with cables energised, continuous monitoring, termed On-Line PD Testing can be performed. Electrical interference can cause problems and the minimum discharge detection level is normally well above the requirements for the routine cable test after manufacture carried out in the factory.

On-Line PD Testing is now considered a better test to determine deterioration of the cable than Off-Line methods.

Olex New Zealand has no experience in Partial Discharge Testing of installed cables.

Test equipment for both Off-Line and On-Line Partial Discharge Testing of installed cables is now available for hire in New Zealand. The circuit may have to be de-energised to install components to enable the On-Line PD Testing to be performed.

AVO NZ can supply test equipment to perform both on-line and off-line Partial Discharge tests.