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TECHNICAL NEWS

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Quarterly Technical Newsletter of Australia's leading supplier of low-voltage motor control and switchgear.

IN THIS ISSUE

Terminations, Good or Bad?

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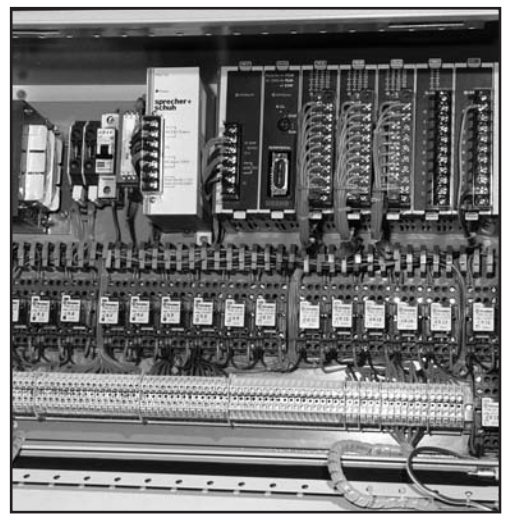
Development Engineer

NHP Electrical Engineering Products Pty Ltd



Terminations, Good or Bad?

The interface between an electrical cable and the device connected to it is often the weak link. Failure at this interface (or terminal) has resulted in fires and/or property damage. There would be few people that have not experienced the problem first hand. It can be the termination of the wires in a simple three pin plug, overheating in a fuse board or the failure of a termination in an appliance. What seems to be the simplest section of an electrical installation can be the most troublesome.

Why does a termination fail?

In the long term every electrical terminal has the potential to fail. Possible corrosion of the contact surfaces will increase the resistance of the joint and the resulting heat produced accelerates the corrosion process.

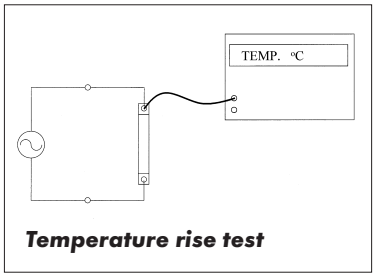
Failure can also start from poor contact pressure causing high resistance and hence high temperatures. Poor contact pressure may even result in the cable falling out of the connector.

What do the Standards test for?

Temperature rise

The operating temperature of a terminal is required to be tested under standard test conditions. This basic test allows a current rating to be assigned to the terminal. The maximum permissible temperature depends on the materials used and is limited to a level which will provide a reasonable life for the contact system.

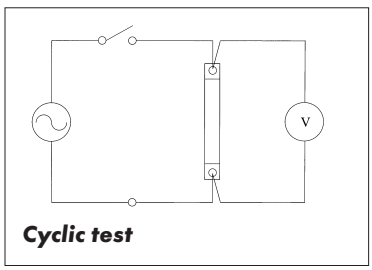
Continued from page 1
What do the standards test for?



Temperature rise test

Cyclic load

The simple temperature rise test does not provide much more than a basic guide to the terminal's performance. It has been found that the cyclic nature of most electric loads can contribute to the failure of terminations. The thermal expansion and contraction causes very small movements which can accelerate the failure. The cyclic load test is applied over a fairly long period of time and success or failure is determined by the amount of any increase in volt drop across the termination.



Cyclic test

A common problem with connecting a stranded cable in a terminal is that movement of the cable can cause the strands to move and loosen the connection.

To cover these possibilities IEC standards have developed the following test procedure:

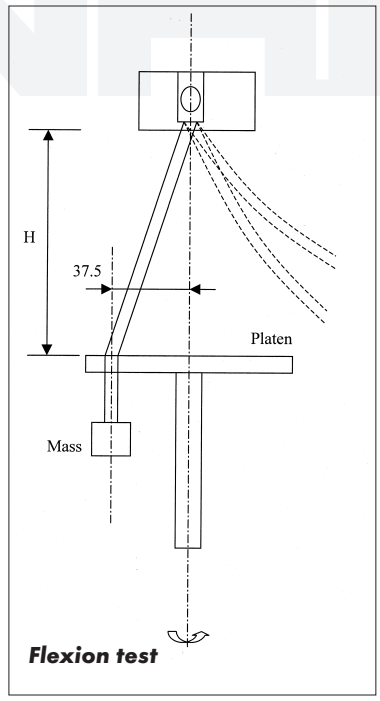
1. flexion test,
2. pull out test.

Flexion test

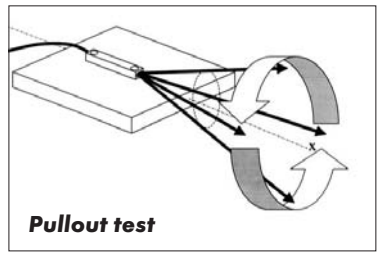
In this test the cable is subjected to 135 continuous circular motions at 10 revolutions per minute at a circle diameter of 75mm. During the test, the conductor must not slip out or break near the clamping point.

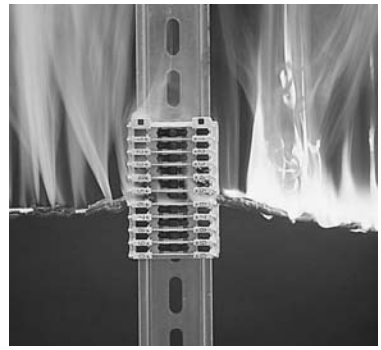
Pull out test

After the Flexion test a Pull out test is applied. A force of about 50N is applied to a 2.5mm cable while it is rotated in an arc around the axis of termination for one minute. It is surprising the number of terminals that will fail this test as the cable pulls out.



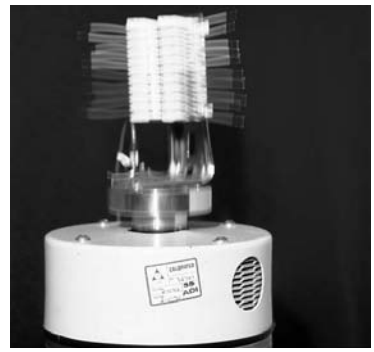
Flexion test


Pullout test


Short circuit test

Short circuit test

A terminal is a likely failure point during a short circuit. The sudden heat produced along with possibly high electromagnetic forces can result in the complete failure of the termination. The tests for short circuit strength are usually designed to represent the let-through energy of the typical protective device for the cable/terminal size being tested.


Vibration test

Vibration

Some applications subject electrical equipment to quite severe vibrations. This regularly occurs with production machinery and mobile applications. Testing is normally conducted over a range of frequencies and applied in different planes.

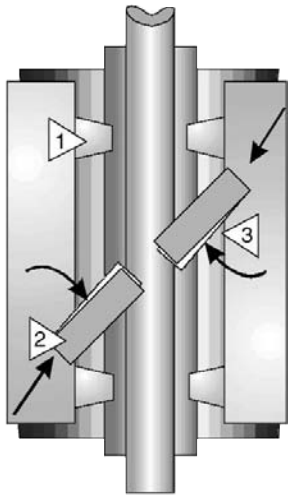
Corrosion

Tests are conducted for corrosion by spraying the termination with a salt solution over a total of 96 hours. Joint performance is checked by measuring the volt-drop across it and failure is recorded if this increases beyond specified limits. Similar tests are also performed using sulphur dioxide gas instead of the salt spray.

Corrosion test

Terminal developments

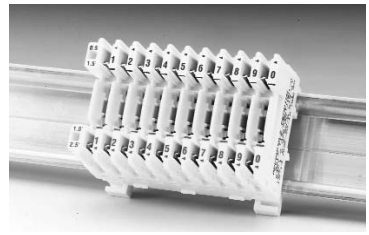
A common cause of terminal failure is simply the failure of the operator to tighten the screw correctly. To eliminate this problem screwless terminations have been developed.



IDC clamping technology used by the Krone terminal marketed by NHP.

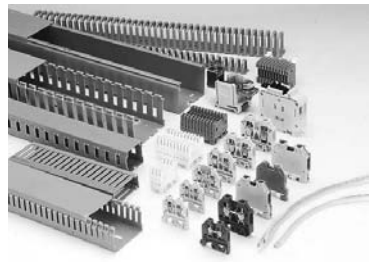
These new terminations are also faster to fit and improve productivity. The latest style of wire termination without screws is the Insulation Displacement Contact (IDC) developed and improved by Krone Australia. In this style of termination the wire is simply inserted into the terminal with a special insertion tool without the need to strip the wire end. This forces the wire into the contact, displacing the insulation at the contact points and the jaws of the contact grip the central conductor of the wire. This forms a gas-tight and secure connection.

While IDC terminations are often met with some scepticism they are proving to be fast and reliable. They have been proven by all the tests mentioned above and are capable of exceeding the performance of many screw type terminations. This technology, long used in the communication industry with great success is now finding its way into industrial control wiring up to wire sizes of 2.5mm^2 (both single-strand and multi-stranded).



Disconnect terminal module

Ergonomic terminator tool



Terminals and ducting

1. Insulation clamping ribs hold the wire firmly in position and isolate the contact area from vibration and other mechanical stress.
2. Flexible, nickel-plated contact tags, arranged at 45° angles across the axis of the wire, make a solid, gas-tight connection.
3. Constant axial or torsional restoring forces, created by the unique contact and plastic housing, maintain a durable connection.

Note: NHP have recently added the Krone "Terminator" product range to their sales programme.

4

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☐ **Terminal catalogue KT**

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