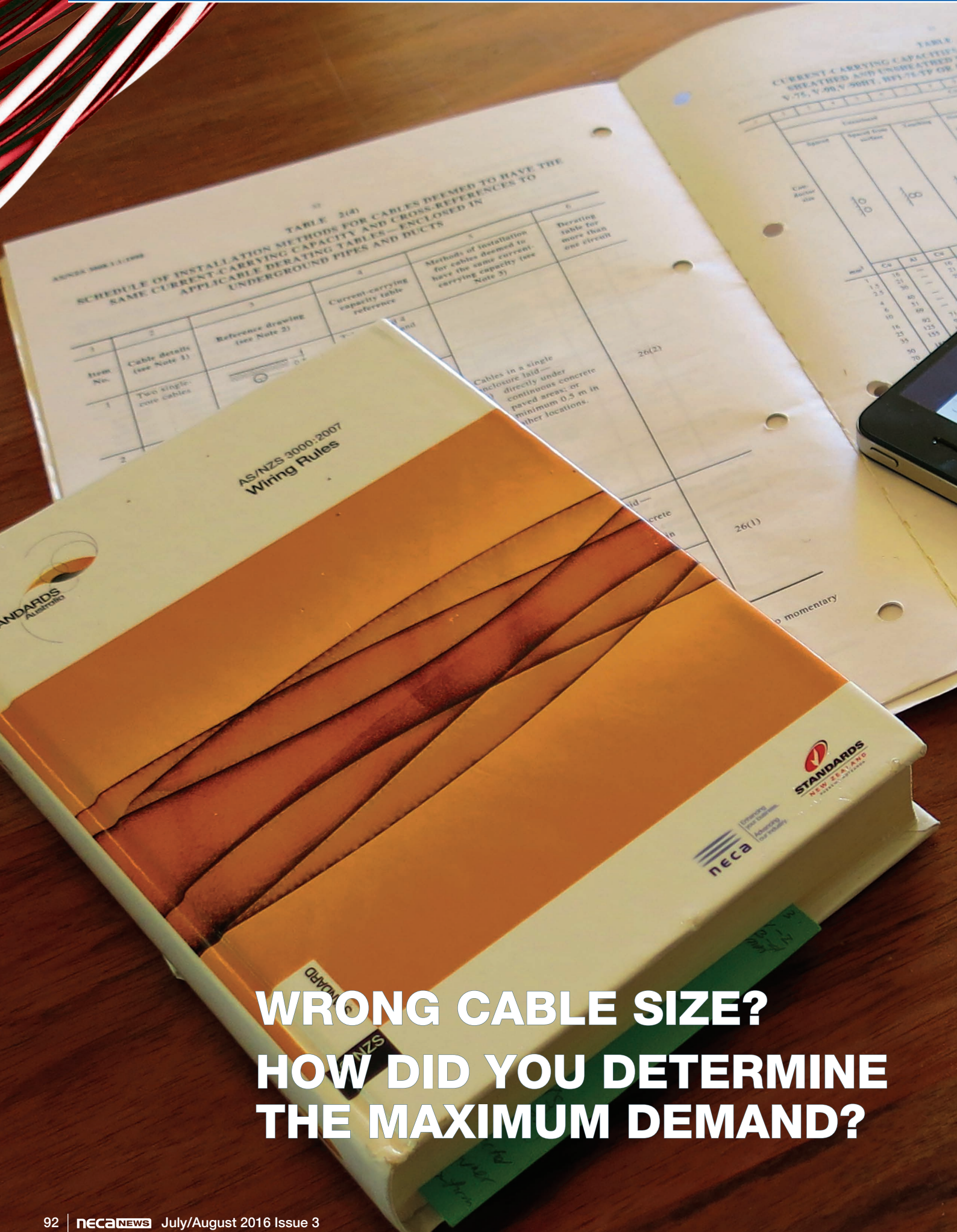


Technical - Wiring Rules



**WRONG CABLE SIZE?
HOW DID YOU DETERMINE
THE MAXIMUM DEMAND?**

During the course of a routine inspection, part of an audit of a recently completed electrical installation, an inspector became concerned over the voltage drop in the installation's cabling system. According to his calculations, the cables were undersized for their intended duty. The inspector deemed that the installation was in breach of clause 3.6 of AS/NZS 3000 as his calculations showed that the installation's total voltage drop was around 12%, well above the 5% maximum prescribed in the Wiring Rules.

The inspector raised his concerns with the registered electrical contractor who promptly produced the calculations made by the Consulting Engineer who had designed the installation. As the engineer's calculations produced a voltage drop value that differed from the inspector's calculations, the contractor decided to do his own calculation. Guess what? The contractor came up with a voltage drop value that was different to both the inspector and the engineer. So how can you get three different values for the same installation? Well without examining all of the calculations, one can only guess at the cause for this discrepancy.

In my experience, the greatest variations in voltage drop calculations are caused by discrepancies in the current values used. In most installations, the cable size, conductor material and cable route length are well known. As cable length is usually accurate to within a couple of metres, the biggest variable is the current. This is where the story gets interesting.

AS/NZ3000:2007 clause 3.6, gives us a few options for determining the value of current to be used in the voltage drop formula. According to the standard, the current need not exceed the –

- (a) Total of the connected load supplied through the circuit; or
- (b) Maximum demand of the circuit; or
- (c) Current rating of the circuit protective device

Seems straight forward enough, right?

Well if we choose option (b) maximum demand, a number of methods open up to us. Clause 2.2.2 of AS/NZS 3000:2007 requires that the maximum demand, in the different circuits of an electrical installation, is determined by taking into account the physical distribution and intended usage of electrical equipment within the installation. The clause allows us to determine maximum demand in one of four ways; calculation, assessment, measurement or limitation. If however, the measured maximum demand exceeds a calculated or

assessed value, then the measured value must be used.

Method one – Calculation

Appendix C of AS/NZS 3000:2007 provides guidance for calculating maximum demand for different types of electrical installations. The Wiring Rules recognise that there may be considerable variations in loading from one electrical installation to another. For this reason, they allow the use of alternative methods that take all information relevant to an installation into account when calculating the maximum demand.

"The clause allows us to determine maximum demand in one of four ways; calculation, assessment, measurement or limitation. If however, the measured maximum demand exceeds a calculated or assessed value, then the measured value must be used."

This leaves the calculation method wide open to interpretation, which explains why different people approaching a calculation for the same installation from different perspectives can end up with very different results.

Method two – Assessment

You are permitted to assess the maximum demand of an electrical installation where; electrical equipment operates under fluctuating / intermittent loads or a defined duty cycle, the electrical installation is large or complex as well as if special

types of occupancy exist.

This method also leaves the determination of the maximum demand current very open to interpretation. It is often referred to as the 'guesstimation' method.

Method three – Measurement

The maximum demand can be determined by the highest current flow recorded by a maximum demand indicator or recorder, sustained over any 15 minute period or periods when demand is at its peak.

Although this method is also subject to interpretation, in my opinion when properly applied, it is the best way to determine maximum demand. Unfortunately, it does have a major drawback. The installation has to be complete and energised before it can be applied. This method relies on recording current over a period of time when the electrical installation is under maximum load. The problem is, how do you determine when the installation is at maximum load? Measurement may inadvertently be conducted during a period of lower consumption. For this reason, it is recommended that the electrical installation is monitored for a minimum of one week to give a true indication of the maximum demand.

Method four – Limitation

This method is commonly used by electrical inspectors because the current value can be obtained immediately from the circuit protection device. This often results in an elevated value of maximum demand and therefore when applied to the voltage drop calculation, can give very high values of voltage drop that are not indicative of the actual voltage drop.

As you can see, the determination of an installation's maximum demand and related voltage drop is not that straight forward. The risk in all of this is that unscrupulous operators may manipulate the maximum demand value to gain a commercial advantage. They can influence the voltage drop calculation to minimise cable sizes. Problems will only become evident if the actual voltage drop is measured. Changing out cabling once the installation has been finalised is a costly business. Who will pick up the tab?

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Need more information?

Electrical installation (known as the Australian/New Zealand Wiring Rules) - AS/NZS 3000:2007

Electrical Installations – selection of cables - AS/NZS 3008.1 series