Technical NEWS

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In this Issue...

WHERE DID THE 10 VOLTS GO?

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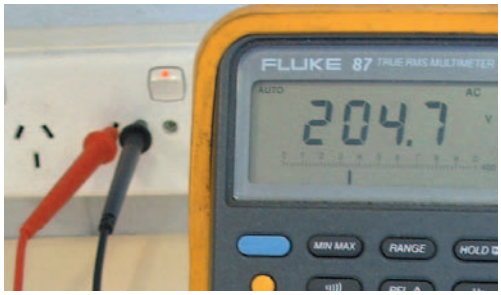
Any person who has travelled overseas would know that in each country the electrical plugs vary and the supply voltage can also be different to Australia. From the global market point of view, this creates problems as electrical products must be manufactured to suit the local conditions. Over many years, there have been efforts made to set global standards for supply voltages and to also design a universal plug and socket system. Australia has not accepted a change to plugs and sockets but it has made efforts to change the volts. To get better compatibility between countries, Australia has decided to move down to a 230 / 400 V system from 240 / 415 V, while other countries have moved up from 220 / 380 V to 230 / 400 V.

1. The Volts Go

The new system voltage levels were introduced during February 2000 by Australian standard Standard voltages AS 60038-2000. This standard is a based on the international standard IEC 60038. Since that date, electrical supply companies have generally tried to meet the requirements of the standard but there is no mandatory requirement for them to do so.



At the outlet you can have between 204.7 V and 253 V

Prior to the new standard, the Australian system was 240 / 415 V +6 % -6 % giving 225.6 to 254.4 volts. It is now 230 / 400 V +10 % -6 % giving 216.2 to 253 volts.
This seems a reasonable approach as it allows existing voltages to be accepted while voltages generally drift down as modifications can be made.

	System voltage	Supply range	Installation volt drop	Total	Total voltage range
Australia to AS 2926-1987	240 / 415 V	-6 % to +6 %	-5 %	-11 % to +6 %	213.6 - 254.4
Australia to AS 60038-2000	230 / 400 V	-6 % to +10 %	-5 %	-11 % to +10 %	204.7 - 253
IEC 60038:1983 (moving from 220 / 380 volts)	230 / 400 V	-10 % to +6 %	-4 %	-14 % to +6 %	197.8 - 243.8
Combined range for universal product	230 / 400 V			-14 % to +10 %	**197.8 - 253**

Products for universal application must operate over a wide voltage range

2. The extra drop

AS 60038 sets the requirements for the voltage at the point of supply to an installation. Within the installation the Wiring Rules allow up to a 5 % volt drop due to the cable impedance. This adds to the lower tolerance and extends the required utilization range for equipment. The utilization range becomes +10 % to -11 %.

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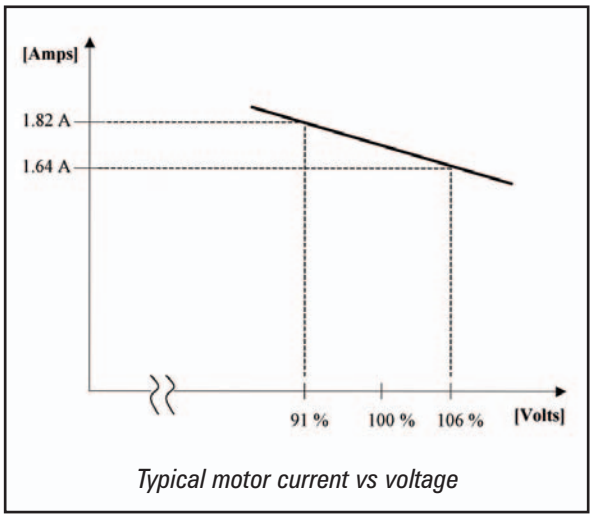
3. Will it work

Excessive voltage can cause early failure

The main purpose of a common standard voltage in different countries is to allow easier trade between countries. Up to now, many electrical products have required different models to cover 220 V and 240 V applications. There have been product failures when 220 V designs have been applied at 240 V.
The 240 V plus the upper variation permitted in the actual supply voltage becomes too great and the life of the product becomes very short.
If you consider an electric room heater with a nominal power rating of 2 kW at 230 V, at the lowest permitted utilization voltage for a 220 V system of 198 V, the actual power output would become 1.48 kW. At the other end of the range, the highest voltage of 240 V system is 253 V and the actual power becomes 2.42 kW. (These results assume no change of resistance of the heater element with temperature.) This power output range is quite large and is an example of a product type that may need different models for different countries.

The initial introduction of the 230 V system has only created an illusion of a world standard as it has largely been introduced by tinkering with tolerances. The initial effect in Australia is virtually no change of voltage at the device. If countries moving from 220 V do the same and do not actually change voltages, a lot of product failures or under performance will result. Manufactures need to be careful not to assume that one model suits all and ensure any product sold as 230 V will perform over the full range of voltages.

The Australian standard (basically a copy of IEC) for voltage, removed the IEC version notes suggesting that countries should keep the transition period as short as possible and also removed the suggestion that after the 230 V standard is introduced, a tighter tolerance should be considered. If the removal of these notes means Australia has no intention of actually fully adopting a 230 V system and other countries do the same, then little has been achieved.
The problem is put back to the manufactures to design products to operate satisfactorily over a broader voltage range.



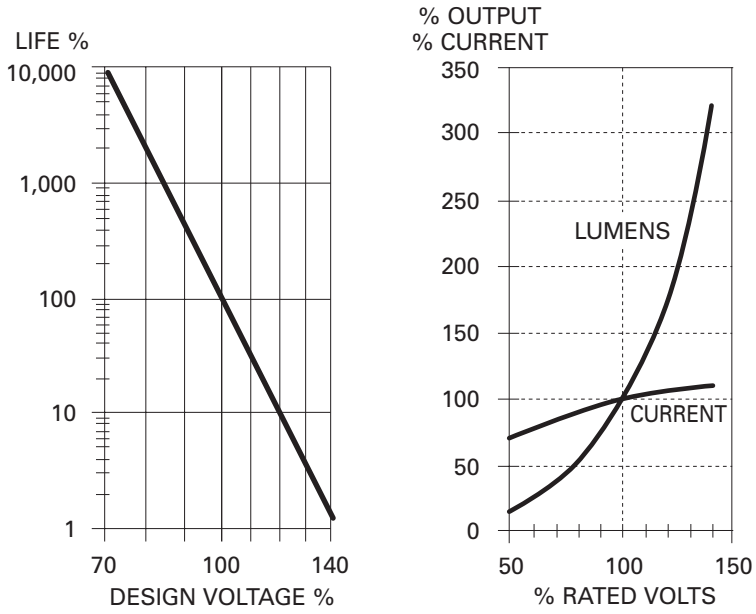
Typical motor current vs voltage

What can the manufacturer do

In the past some products were just branded 220 V or 240 V without internal change. As can be expected, some designs could withstand the voltage variations while other could not. The result therefore was usually a different product for each voltage level. The problem now is that we have countries saying they are 230 V standard, but if a single design is produced, it still must be able to operate at the minimum voltage of the 220 V systems through to the maximum voltage of the 240 V systems. It would seem that for a while at least products should still be optimised for the old voltage levels of the different countries.

4. What do the products do

An incandescent light bulb burns bright at higher voltages but its life is greatly reduced. A motor might still operate at low voltages but the increased current drawn may cause it to overheat. For each type of device, voltage variations will cause different problems. The result can be failure, reduced performance or no effect.



Device type	Increased voltage	Reduced voltage	Ability to accommodate wide range
Lamp	Higher light output, shorter life	Lower light output, longer life	Poor, unlikely to be improved
Motor driven products	Little effect up to limit of designed range	Reduces torque and increases current	Can be designed for wide range but at an extra cost
Heater type products	Extra output and possible life reduction	Reduced output, possible unsatisfactory performance	Performance variations difficult to eliminate
Electronic (basic input)	Extra heating of some components, shorter life	Possible non performance	Wide range can be designed for, generally at extra cost

Typical performance changes

5. The electricity suppliers problems

The provision of a constant supply voltage is not possible, as the load on the system varies so will the voltage. Existing distribution transformers have been designed around 240 / 415 V and it will be many years before they are replaced. Generally the tap changing facilities provided on the existing equipment will allow for the 10 V drop, but the design of new equipment needs to take into account the change in standard. Therefore at present, electricity suppliers are happy to accommodate the new standard, but to tighten the tolerance in the future may not get full compliance as old equipment may need to be replaced.

6. Conclusion

While uniform supply voltages around the world can help promote a global market, the problems created by the required changes may make the transition period difficult for some electrical products. Manufactures should not rush to produce a universal 230 V product if they have been producing different versions for 220 V and 240 V systems. It would be best to wait until the next stage arrives and the tolerances are tightened on the permissible voltage variations. This could take many years.

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