

INFORMATION SHEET

240V hand tools: the risks

(The following background information has been prepared to provide further detail to accompany a safety alert issued by NOPSA on the topic of 240V hand tools).

NOPSA has issued Prohibition notices preventing the use of 240V hand tools in certain circumstances. The notices were followed with a NOPSA safety alert warning industry participants of the potential dangers of such tools and highlighting alternatives such as air tools and battery powered tools.

Here NOPSA provides more detail on the risks involved, and how the goal-setting nature of the *Offshore Petroleum and Greenhouse Gas Storage Act* (OPGGSA) allows greater flexibility for reducing the risk of electrocution from hand-held electrical equipment.

The 240 volt hazard.

The hazard of using portable electrical equipment rated at or above 240 volts arises when either the equipment itself develops a fault or, more commonly, when the supply cable is damaged, resulting in exposed live conductors. Anyone coming into contact with a conductor live at or above 240 volts runs the risk of suffering a fatal electric shock, as described in Appendix 1. The offshore work environment offers plenty of opportunity for trailing leads to be damaged and if this happens, there is a chance that someone can receive a shock.

Contact with 240 volts can deliver over three times the current required to kill an average person. There have been many electrocutions on 240V systems, with some of these on circuits fitted with residual current devices.

What should you do about the risk?

Clause 9(1)(b) of the *Offshore Petroleum Act 2006* requires operators to take all reasonably practicable steps to ensure that all work and other activities carried out on the facility are carried out in a manner that is safe and without risk to health.

Good practice in reducing risks to as low as is reasonably practicable (ALARP), requires a hierarchical approach. This means that the first step in any situation should be the elimination or substitution of the hazard wherever possible. The next level down on the hierarchical approach is to introduce some engineered protective system. Lower down the hierarchy again come procedural measures, and the use of personal protective equipment (PPE).

Reliance on procedural methods or PPE to protect against electric shocks is not acceptable for electrical faults.

This leaves two other approaches: removal of the hazard, or the use of an engineered protective device or system.

The traditional approach onshore has been to use the engineered protective method of residual current devices rather than eliminate the hazard itself. This has been driven, in part, by Australian standards on hand tools requiring them to be rated at 240V, despite the greater risk of electrocution.

Appendix 2 discusses why residual current devices are not always the best means of preventing electrocutions.

The risk of fatalities from electric shock is completely eliminated by the use of air-driven or battery-powered tools.

The lack of prescription under the OPA allows Operators and others who have duties of care under the OPA to consider alternative means of eliminating the risk of fatalities, such as hand tools rated at 110V fed by isolating transformers with centre-tapped secondary windings. There are no known electrocutions from this system of supply.

Given that there are a number of means for eliminating the risk of electrocutions, **the ALARP principle of eliminating the hazard should be the first step considered by anyone with duties of care imposed by the OPGGSA** and its subsidiary legislation. Residual current devices should be used only where it is not practical to use alternatives, and even then only when suitable arrangements for regular testing and inspection are in effect, and in conjunction with another means of protection such as extra protection of trailing cables from mechanical damage.

Appendix 1: The effect of voltage level on the potential lethality of an electric shock

The Australian Standard¹, AS 60479.1:2002 discusses the effect of current on human beings:

The impedance of the human body decreases with an increase in voltage in a non-linear way, as Table 1 from AS60479 shows:

Values for total body impedance (ohms) that are not exceeded for a percentage (percentile rank) of			
Touch Voltage(V)	5% (of population)	50% (of population)	95% (of population)
25	1750	3250	6100
50	1450	2625	4375
75	1250	2200	3500
100	1200	1875	3200
125	1125	1625	2875
220	1000	1350	2125
700	750	1100	1550
1000	700	1050	1500
Asymptotic	650	750	850

For a nominal voltage of 240V, a figure for the shock current can be calculated using Ohm's law. The impedance taken from the 50% column of the table, 1350 ohms, delivers a maximum current of $240/1350 = 178\text{mA}$.
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Figure 14 in AS60479 shows a low-end figure for the current that can cause fatal effects as being around 50mA. The level of 30mA is shown as not having a high probability of permanent effects.

If the shock was delivered by an isolated, centre-tapped earth supply, the voltage would be 55V. Estimating an impedance of 2500 Ohms from the table, this gives a current of 22mA, which is well below the 50mA threshold.

Appendix 2: A discussion on the effectiveness of residual current devices in offshore workplaces.

Residual current devices measure imbalances between the current flowing into and out of a device such as an electrically powered hand tool. If the difference between the two currents exceeds a pre-set value, usually 30mA for personnel protection, caused, for example, by current flowing through a member of the workforce to earth, then the circuit is automatically broken.

Such devices cannot detect cases of electric shocks caused by current flowing between 'active' and 'neutral' conductors.

Residual current devices are known to fail, and the test buttons on them often only test the mechanical circuit breaker mechanism, not the operation of the electrical measurement part of the device.

The Australian standard, AS 3000:2007, recognises these limitations when it states:

“RCDs are not recognised as a sole means of basic protection (in normal service) but may be used to augment one of the means set out in Clause 1.5.4.2.”

¹ Australian Standards are developed by Standards Australia and are distributed by SAI Global.