

TECHNICAL GUIDE:

# Electrical Safety and Power Generation

NCCTRC MINIMUM STANDARDS

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NATIONAL CRITICAL  
CARE AND TRAUMA  
RESPONSE CENTRE

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## Reference:

Wattage Estimation Guide Electrical appliances	<a href="http://powerequipment.honda.com/generators/generator-wattage-estimation-guide">http://powerequipment.honda.com/generators/generator-wattage-estimation-guide</a>
National Critical Care Trauma Response Centre (2011) Australian Medical Assistance Team Training, version 3.	<a href="http://www.nationaltraumacentre.nt.gov.au/sites/default/files/PDFs/AUSMAT_2011_web.pdf">http://www.nationaltraumacentre.nt.gov.au/sites/default/files/PDFs/AUSMAT_2011_web.pdf</a>
Table 1: (Maximum lengths of flexible cords and flexible cables) as per AS/NZS 3012: 2010 Electrical installations – construction and demolition sites.	<a href="http://www.safework.nsw.gov.au/media/publications/health-and-safety/electrical-practices-construction-and-demolition-sites-fact-sheet">http://www.safework.nsw.gov.au/media/publications/health-and-safety/electrical-practices-construction-and-demolition-sites-fact-sheet</a>
Queensland Government, Dept of Education, Training and Employment (2014) Guide to Managing Electrical Safety in Education Queensland Schools (v2)	<a href="http://education.qld.gov.au/health/pdfs/healthsafety/electrical-safety-guide.pdf">http://education.qld.gov.au/health/pdfs/healthsafety/electrical-safety-guide.pdf</a>

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## Glossary of terms

Term	Definition
AusMAT	Australian Medical Assistance Teams, who are deployed by the NCCTRC.
AusMAT deployee	Person from AusMAT register who is deployed on an AusMAT mission. The register includes volunteers who are 'ready' to deploy (i.e. current passport; deployment-MOU with employer; vaccination status; etc.) and 'not ready'. When not deployed an AusMAT deployee is known as a 'register volunteer'
ELD	Earth Leakage Device (also known as a Residual Current Device (RCD). A safety trip device which interrupts supply.
EMT	Emergency Medical Team, previously known as FMT (Foreign Medical Team)
EMT 1	This provides outpatient initial emergency care of injuries and other significant health care needs. Daytime services capable of 100 patients/day.
EMT 2	This provides inpatient acute care, general and obstetric surgery for trauma and other major conditions. It delivers services day and night; has one operating theatre with 1 operating room and 20 inpatient beds; and, can perform a minimum of 7 major or 15 minor operations/day.
EMT 3	This provides complex inpatient referral surgical care including intensive care capacity. It delivers services day and night; has one operating theatre with at least 2 operating rooms and 40 inpatient beds and 4-6 intensive care beds; and can perform 15 major or 30 minor operations per day.
KVA	Kilovolts-amps. A term used to define generator outputs
MoH	Ministry of Health, this being the head agency/department for health in the disaster-affected country.
NCCTRC	National Critical Care and Trauma Response Centre (referring to the Darwin office unless specified otherwise), which trains, administers, resources, and coordinates the deployment of AUSMAT register volunteers.
PSOA	Portable Socket Outlet Assembly
RCD	Residual Current Device, or safety switch, is an electrical wiring device designed to disconnect current to prevent serious harm from an ongoing electrical shock.
State Representatives	NCCTRC coordinators in each state who are responsible for maintaining the deployment status (as 'ready') of their respective register volunteers, i.e. personal details and currency of passport/vaccinations/medical registration.
WHO	World Health Organisation

# 1. Overview

The National Critical Care and Trauma Response Centre deploy AusMAT Emergency Medical Teams to disaster affected regions both nationally and internationally. In the context of Power Generation the team must be self-sufficient for the duration of the deployment.

AusMAT units are required to be self-sufficient across all areas of response and must transport and maintain power generation units that are safe and fit for purpose. This includes alternates and contingencies.

Power Generation and associated equipment is the responsibility of logistics officers, however all AusMAT personnel must use the right electrical equipment for the task and report any issues.

The mission objectives of a deployed AusMAT EMT are heavily dependent on the safety, security and wellbeing of its personnel, both in the field and after returning home. Electrical safety and power generation are a critical element to achieving mission objectives.

## 1.1 Additional considerations

An NCCTRC deployed AusMAT must be versatile and adaptable to a variety of conditions.

Electrical safety is paramount and this is based on Australian standards and best practice.

The conditions of deployments will be varied and the AUSMAT EMT must be

have the capability to maintain stable, clean and reliable power generation and distribution networks for sensitive electronics.

Safety systems must be in place that is suited for the varied conditions of deployments.

## 1.2 Safety Briefings

Safety briefings and reporting are an essential element of any mission. All personnel in the field must understand their obligations to electrical safety,

including being vigilant for any potential hazards which they may encounter (see Sect.5)

# 2. Power Supply and Generation

The NCCTRC AUSMAT cache requires a vast range of power supply and generation to suit a variety of EMT configurations.

Power supplies begin with battery packs and solar power systems for electronics, such as computers and satellite Internet systems. Followed by a combination of petrol and diesel power generators in varying size and outputs to meet the uncertainty of fuel supplies post disasters. This also includes the ability to transport units and contingencies for breakdowns.

Spare part kits are an essential item for the duration of deployments; this includes parts for scheduled maintenance and breakdowns.

While smaller EMT facilities may require only small lightweight generators, larger EMT's may require large diesel units to power equipment such as environmental control units (air conditioners/heating units) and autoclaves.

Each generator must have the minimum safety features of ELD's and earth stakes.

### Key Points:

Contingencies for breakdowns must be considered.

Spare parts for scheduled service and routine maintenance are required.

Fuel filters can be a high use item

## 2.1 Distribution Networks

A NCCTRC AusMAT may be required to distribute power over a large area to a variety of differing facilities within the EMT, this includes both single and three phase networks.

All power distribution cables and extension cords outside of the EMT facility shelters must be fitted with waterproof industrial fittings

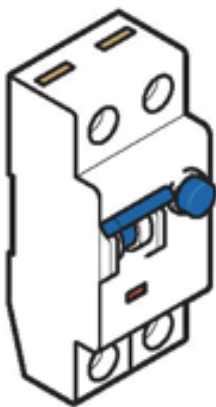
## 2.2 Generator Operation

When operating from generator power it is essential to prioritise equipment to be powered. This is to ensure that generators are not overloaded unnecessarily.

(See page 11 [4 Power Consumption](#)).

Some safety considerations when operating generators

1. Locate generators in well ventilated areas and aim exhaust away from working areas as they create carbon monoxide
2. Keep the generator dry and always operate it on a level surface away from dust and sandy conditions
3. Ensure the generator is off and cool before refuelling. Fuel spilled on hot engine parts may ignite



Fixed RCD protection

## 2.3 RCD or safety switch protection

All circuits within the network must be protected by an RCD (residual current devices). An RCD is an electrical safety device designed to immediately switch off the supply of electricity when electricity 'leaking' to earth is detected at harmful levels .

RCDs offer high levels of personal protection from electric shock.

RCD protection will either be fixed (ie from the generator switchboard) or portable (RCD protected power board or inline devices)

RCDs must be checked regularly by the use of the 'test' button, to ensure that they are operating correctly.



Portable Socket Outlet Assembly (PSOA) with RCD protection

## 3. Operations

### 3.1 Operational Performance Parameters

NCCTRC AusMAT EMT facilities use a combination of 230/240V single phase 10/15 amp Australian three pin plugs/ outlets and a combination of Australian and European 440V three phase 20/35 amp plugs/outlets.

Some equipment with EMT facilities may require sine-wave technology to limit the possibility of damage to sensitive electronics.

The NCCTRC carries sine-wave generators for this purpose.

#### 3.1.1 Portable socket outlet assemblies

All portable socket outlet outside of the EMT facility shelters must be fitted with waterproof industrial fittings.

Domestic type power boards may be used indoors and double adapters and three pin plug adapters (piggy back) plugs should be avoided.

#### 3.1.2 Cord extension sets (commonly known as extension leads)

Cord extension sets should not be joined so that the total length of any combination exceeds the relevant maximum value specified in [Table 1](#)

(Page 9: *Table 1 Maximum length of most commonly used single phase cord extension set.*)



**Table 1: (Maximum lengths of flexible cords and flexible cables) as per AS/NZS 3012: 2010 Electrical installations – construction and demolition sites.**

[www.safework.nsw.gov.au](http://www.safework.nsw.gov.au)

[www.safework.nsw.gov.au/media/publications/health-and-safety/electrical-practices-construction-and-demolition-sites-fact-sheet](http://www.safework.nsw.gov.au/media/publications/health-and-safety/electrical-practices-construction-and-demolition-sites-fact-sheet)

Current rating (A)	Conductor size (mm <sup>2</sup> )	Maximum length (metres)
10	1.0	25
	1.5	35
15/16	1.5	25
	2.5	40
20	2.5	30
	4.0	50

**NOTE:** Lengths quoted for flexible cords are taken from AS/NZS 3199 and are based on a voltage drop of 5% of 230V at rated current for the conductor size.

## 4. Power Consumption

The Power consumption of the AusMAT EMT needs to be monitored to ensure power generations systems are not overloaded or essential equipment is not compromised.

New equipment cannot be simply introduced with consultation with the logistics team.

## 4.1. Calculating Power Consumption

Most electrical appliances tag their appliances with power usage in Amps, this may require a simple conversion to Watts for ease of calculations for non-electrical trades personnel.

Some Common Applications	Approximate Starting Wattage	Approximate Running Wattage
Refrigerator or Freezer (Energy4 Star)	1200	132-192
Microwave Oven 800 watts	1300	1300
Commercial Urn 20lts	2400	2400
Flat Screen Television (46")	190	190
Electric Fry Pan	1500	1500
Clothes Dryer (Electric)	6750	5400
Radio	50 to 200	50 to 200
Sump Pump		
1/3 Horsepower	1300	800
1/2 Horsepower	2150	1050
Window Air Conditioner (10,000 BTU)	2200	1500
Laptop computer	200-250	200-250
Monitor (LCD style)	30	30
Printer	400-600	400-600

For the purpose of simple estimates

1000 Watts = 1 Kva

Volts x Amps = Watts

Watts/Volts = Amps

Some appliances can require up to three times their normal running power during start up.

<http://powerequipment.honda.com/generators/generator-wattage-estimation-guide>

## 5. Electrical Safety

### 5.1 Equipment

1. Suitably qualified electricians are required to make any modifications or onsite repairs to electrical equipment.
2. All circuits must be protected by a ground fault circuit interrupters such as Earth Leakage Devices (ELD)/ Residual Current Devices (RCD).
3. Power distribution cabling must be installed in a way that reduces trip hazards and limits mechanical contact with both pedestrian and vehicular traffic.
4. All generators must utilise a earth stake.
5. All electrical appliances and cabling must undergo "test and certification" per Australian standards.
6. On deployment regular safety and compliance inspections of the power network and appliances is required.
7. Generators must be placed in a well ventilated area and separated from public access.

### 5.2 Potential Hazards

Electricity travels in closed circuits and wants to reach the ground any way it can. If a person comes in contact with electricity they become its conduit to the ground .

AusMat personell need to be aware of any potential shock hazards. If any of the following warning situations occur, they need to be taken seriously, power has to be disconnected and the equipment taken out of service until it is checked by an authorized person.

1. Mild shock or tingling when in contact with an electrical machine.
2. Frayed or exposed wires.
3. Excessively hot motors
4. Unusual odours such as burning insulation
5. Sparks or smoke
6. Melted plastic on appliance casings or leads
7. Circuit breakers or RCDs that operate for no obvious reason