

# Mains Failure Plant

ESA-09-03

## Applicability

ARTC Network Wide

SMS

## Publication Requirement

Internal / External

## Primary Source

SPS 26 Mains Failure Plant (v1.2) - NSW Standard

## Document Status

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1.0	4 Nov 20		First issue. Supersedes SPS 26 – NSW standard.
1.1	04 Oct 22	various	Updated the requirements of Automatic Transfer Switch, Canopy, and other minor changes. Added reference to the applicable Australian Standards

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## 1 Introduction

### 1.1 Purpose

The purpose of this document is to specify the requirements for mains failure plant used as a standby power supply for signalling systems on the ARTC Network. Mains failure plant comprises of a diesel engine (primary movement) driven alternator (secondary movement) which starts automatically when the mains supply fails, this arrangement will be referred to as a Generator Set in this document.

### 1.2 Scope

The minimum safety requirements for a Generator Set used on the ARTC network are provided in AS/NZS 3010:2017 Electrical Installations – Generator sets, supported by this document to provide additional guidance on ARTC requirements.

### 1.3 Document Owner

The General Manger - Technical Standards is the Document Owner. For any queries, initial contact to be made at [standards@artc.com.au](mailto:standards@artc.com.au)

### 1.4 Responsibilities

The Project Manager (for projects), Work Group Leader (for maintenance) and Signal Maintenance Engineer are responsible for the implementation of this specification.

The supplier is responsible for compliance and confirmation to this specification and applicable Australian Standards.

### 1.5 Reference Documents

The following documents support this standard:

- AS/NZS 3010 Electrical Installations – Generating sets
- AS 1940 The storage and handling of flammable and combustible liquids
- AS/NZS 3000 Australian/New Zealand Wiring Rules
- AS/NZS 4055 Wind loads for housing
- AS1562 Design and installation of metal roof and wall cladding Metal
- ESA-11-02 Cables for Railway Signalling Applications – General Requirements

### 1.6 Definitions

The following terms and acronyms are used within this document:

Term or acronym	Description
Alternator	Secondary movement converting Mechanical to Electrical energy
ARTC	Australian Rail Track Corporation
Engine	Primary movement providing Mechanical energy
PER	Power Equipment Room
UPS	Uninterruptible Power Supply

## 2 Requirements of this Specification

### 2.1 General

The Generator Set and associated equipment shall be housed in a free standing, dedicated enclosure which is to be located outside and separated from the power equipment room. The engine and alternator shall be directly coupled and mounted on a common fabricated powder coated steel base-frame with anti-vibration mounting. The powder coating should be specifically for external applications. The alternator and base must be physically matched, in accordance with the manufacturer's requirements.

### 2.2 Engine

The engine should be of sufficient capacity to provide adequate mechanical energy to operate the alternator continuously at full load.

The engine shall be air-cooled.

The engine governor (speed controller) shall maintain frequency regulation within +/-3% of the nominal 50Hz from no load to full load via a load responsive governor.

The engine shall be equipped with an electric self-starter motor, a fuel filter, a lubricating oil filter, an intake air filter and other auxiliary equipment.

The sump capacity and oil filtration system of the engine shall be sufficient to allow for 100 hours of continuous operation without topping up or other manual intervention. If necessary, the engine shall be equipped with an oil cooler to maintain oil temperature within manufacturer's specification.

An oil sump drainpipe shall be fitted and shall clear any housing or mounting equipment. It is desirable that the oil sump have a pump facility to remove engine oil when servicing on the engine.

The engine shall be run at full load capacity for a minimum of 2 hours under normal ventilation conditions prior to being commissioned. 'Running-in' of the engine shall be conducted by the manufacturer.

A test certificate will be issued to provide proof that the following checks have been carried out:

- Visual Inspection of all parts.
- All fittings and connections (mechanical and electrical) are correct and have been checked for security.
- All necessary fluids and their levels have been checked.
- The alternator output voltage and frequency are correct.

Only ARTC approved cable types contained in ARTC standard ESA-11-01 should be used between the Power Equipment Room (PER) and the Generator Set.

The type, size and rating of the cables to be determined by the site-specific application and shown as part of Signalling Detailed Design which will include:

- Power cable.
- Battery charger cable.
- Control / Alarm cable.

Terminals shall be housed in a PVC enclosure and mounted to reduce vibration. Adequate room shall be provided for the cable terminals and mountings, so that the flow of air through the

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alternator is not restricted. All terminals shall use vibration resistant cage clamp technology, e.g. Wago type terminals.

Industrial wiring connectors with a IP68 rating shall be used for all sensing/control units on the engine e.g. low oil or fuel pump. ARTC prefers Deutsch DT or HD series as applicable to the application, other options may be considered and the approved by ARTC prior to supply.

### 2.3 Engine battery

An ARTC approved Absorbed Glass Mat (AGM) starting battery shall be used, suitable for continuous float charging with a minimum capacity (without recharging) of 90 seconds continuous cranking or a time equal to 300% of the normal three start cycle whichever is the greater.

Batteries shall be capable of operation and charging over the ambient temperature range of -3°C to 45°C.

The battery shall be charged by a constant potential charger which is operated from the guaranteed supply and contained in the alternator control panel.

The starting battery shall have an expected design life of not less than three years in the environmental conditions within the housing provided for the Generator Set.

### 2.4 Engine isolation

Engine Isolation shall be provided by an isolation switch that can be secured in the open position (refer to AS/NZS 3010:2017 – Electrical Installations – Generator Sets).

Two Emergency Stop buttons shall be provided, the operation of either switch shall immediately stop the unit and prevent the unit from starting. The Emergency Stop buttons should be located on either side of the generator with easy access from the enclosure door.

External Emergency Stop buttons are not to be installed as they open to vandalism or misuse.

### 2.5 Engine exhausting

An exhaust with a silencer shall be installed in accordance with the engine manufacturer's recommendations. If there is a requirement for the exhaust to protrude from the enclosure by more than 300mm all exposed exhaust parts are to be fitted with an approved stainless-steel cover to prevent the risk of burn injuries and a rain deflector.

Maximum sound pressure levels of the generating set shall comply at least with AS/NZS 3010:2017 – Electrical Installations – Generator Sets.

### 2.6 Fuel Tank

The fuel tank shall have sufficient capacity to provide a minimum of 30 hours of continuous running at 75% Full Load Capacity.

The fuel tank shall be manufactured from steel with a suitable powder coating. ARTC may approve any alternative type of tank that may be proposed. The fuel tank shall be restrained to prevent movement within the enclosure.

Tanks shall be designed to allow condensation to be easily collected and removed. The fuel intake line inlet shall be raised to prevent condensation collected inside the tank from entering the fuel line.

The tank shall be equipped with a manual shut off valve. The fuel level should be monitored and conveyed in real time to the ARTC Alarm Management System.

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The tank shall be filled with sufficient fuel for 24 hours running prior to commissioning and after all "Running in" tests have been completed. An anti-fungus agent such as PETROTEC shall be added to fuel to reduce fungus growth.

An anti-siphon device and a vandal proof entry shall be fitted to the fuel tank.

## 2.7 Bunding

Internal bunding should be provided with sufficient capacity to contain all fluids in the engine and fuel tank with an allowance for thermal expansion volumes.

Drainage facilities will be provided to allow banded spills to be readily removed from site with low risk of spill during the removal operation.

## 2.8 Alternator

The alternator shall produce an output of either;

- 120v 50Hz single phase,
- 240V 50Hz single phase,
- 415V 50 Hz single-phase,
- 440v 50Hz single phase or
- 415V three-phase 50Hz
  - As shown in the approved Signal Design for the site.

The alternator output shall be rated to the maximum of the following:

- the load drawn by the UPS under Peak Load conditions plus the non-critical standing load; or
- sufficient to handle the total harmonic distortion on load imposed by the UPS (approximately 150% of the UPS input load).

The alternator shall be fitted with ball or roller bearings. It shall be self-exciting and have a voltage regulation of  $\pm 3\%$  no load to full load.

The name plate ratings of the alternator shall be greater than the standing signalling essential load (allowing for the efficiency of the UPS). The name plate ratings of the alternator may be exceeded when supplying the standing load plus short term load (allowing for the efficiency of the UPS) provided that the required voltage regulation limits are not exceeded.

The unit shall have an enclosed cable entry/exit point, providing for vibration, mechanical protection and vermin proofing and shall provide access for any required maintenance or settings.

## 2.9 Control panel & control equipment

The preferred controller is the Deepsea 7420 MkII, in the event that this controller is no longer available ARTC will consider an alternative with the same or similar functionality. The controller should be able to connect to ARTC Alarm Management System via Ethernet and should have the capability of SNMP communication protocol. The control equipment shall provide for manual and automatic starting, change over and shut down. The main and standby contactors shall be mechanically and electrically interlocked. All terminals are to be vibration resistant and be of adequate size for the cable required.

## 2.10 Automatic Transfer Switch (ATS)

It is preferred that the ATS is mounted in a secure Stainless-Steel enclosure located at the generator set rather than in a separate Power Room, any deviation from this arrangement should be agreed with the ARTC Signal Maintenance representative.

## 2.11 Automatic operation

The control equipment shall provide for three starting attempts under automatic operation.

The starting sequence shall initiate when the mains voltage has been continuously outside the voltage range of the main supply for 10 seconds.

Change over from Standby Supply to Mains Supply should be initiated when the Mains Supply voltage has been continuously within the range of its rated voltage  $\pm 6\%$  for five minutes.

Engine shut down shall be initiated immediately after change over to Mains Supply or after a pre-set delay if the engine manufacturer recommends a period of no load running prior to engine shutdown.

## 2.12 Selection of operation mode

The control panel shall provide facilities to select Manual and Automatic operation as described below and also for isolation of the unit.

- The 'off' setting shall inhibit both manual and automatic starting.
- The 'manual' setting shall provide for both loaded and unloaded operation of the set using start, stop and change over functions being controlled by means of push buttons mounted on the front of the control panel or the controller. Automatic starting is to be inhibited in this position.
- In the 'auto' setting the Generator Set shall start, changeover and shut down automatically as required, due to loss of mains.

## 2.13 Remote start facility

Functionality shall be provided to remotely start the Generator Set when in the auto mode. The command to initiate the start sequence shall be provided externally to the Generator Set in the form of a closed voltage free contact. Once started, the supply shall automatically change over to the Standby Supply. The Mains Supply shall be reconnected once the command relay contact opens and the conditions for minimum alternator run time have been satisfied.

## 2.14 Protection and alarms

Automatic protection (effective in both the 'auto' and 'manual' positions) shall be provided against low oil pressure, and high temperature. The low oil pressure protection circuit shall incorporate a time delay in its operation, to allow sufficient time for the oil pressure to build as the engine is started after a prolonged period of idleness.

Individual latched indications should be provided on the control panel for failure to start, failure to generate, high temperature, low oil pressure.

A single alternator failure indication (available as a voltage free contact) should be available for remote indication. The alternator failure indication shall also be set when the 'off-manual-auto' switch is in the 'manual' or 'off' position.

## 2.15 Other indications

A mains available indication shall be provided on the front panel of the control cubicle. The mains should be considered available when the mains voltage is within the range of its rated voltage  $\pm 6\%$ .

Indications of 'Power Off' and 'Alternator Running' should be provided as voltage free relay contacts for remote indication via the signalling telemetry. The 'Power Off' indication shall be the logical repeat of the mains available state.

The control panel should display at least the following indications:

- Engine run hours
- Load current
- Mains voltage & frequency
- Alternator voltage & frequency
- Battery charge
- Each fault condition separately

## 2.16 Interface terminals

Voltage free contacts provided for remote indications and controls requiring external connections should be wired to a suitable termination strip consisting of vibration resistant cage clamp technology terminals, such as Wago type terminals, to allow external connections to be made without interference with control panel wiring.

## 2.17 Canopy

A canopy shall be provided to afford the Generator Set general weather protection and assist thermal protection. The canopy frame should be constructed from galvanised steel with a coated steel roof to meet current AS1562 standard and should be constructed to withstand a wind class rating, relevant to location of install as defined in the AS 4055-

The roof shall extend a minimum of 1000mm from sides of generator with a fall of 100mm from front to back, draining away from the track.

The designer shall supply detail drawings and requirements of the type and rating for the structural concrete to support structure

## 3 Manuals

The manufacturer shall supply a hard copy of the engine, alternator and controller manuals. An electronic copy of all manuals shall be provided to ARTC.

## 4 Warranty

The manufacturer shall supply a minimum of 24 month warranty.

## 5 ISO9001 Certification

It is a general condition of approval that the supplier is accredited to ISO9001 specifically for these products.