

48V & 110V D.C SUPPLIES

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PURPOSE AND SCOPE

This document defines the functional and performance requirements for 48 V and 110 V D.C. power supply systems in National Grid (NG) substations.

This specification is part of a hierarchical structure of documentation comprising three levels of Technical Specification. This document is a Level Three Specification.

PART 1 – PROCEDURAL

1 GENERAL REQUIREMENTS

- 1.1** 48V D.C. equipment shall be provided for powering protection, control, telecommunications and other light current equipment requiring 48 volt supplies. 110 V D.C. power supply equipment shall be provided for the operation of protection and control equipment including equipment operation such as circuit-breaker tripping.
- 1.2** 48v D.C. and 110v D.C. systems shall comprise a D.C. supply system and a D.C. distribution board. The D.C. supply system shall be either a battery & charger D.C. supply system or a Compressed Air Energy Storage (CAES) D.C. supply system.
- 1.3** The manufacturing facilities for system production shall be certified by a recognised accreditation organisation to BS EN ISO 9001.
- 1.4** The suppliers of D.C. systems shall preferably have in place or be working towards installation of management systems compatible with the international environmental management system standard ISO 14001.
- 1.5** 48V & 110V equipment shall conform to the requirements specified in TS 2.19 Ancillary Light Current Equipment.

- 1.6** All battery & charger D.C. supply systems shall meet the requirements of BS EN 50272-1-2010 and BS EN 50272-2-2001

Substation D.C. Supply Arrangements

- 1.7** Each system shall be duplicated and segregated both electrically and physically so that in the event of loss of one system the other supply shall be maintained and capable of supplying the load. The overall requirement of the system is stated in NGTS 2.12. The means of achieving this duplication is dependant on the type and layout of the substation.

Informative: Substations are of two types; Air Insulated Substations (AIS) and Gas Insulated Substations (GIS). Generally, AIS substations at the higher voltages have dispersed relay rooms, whereas GIS substations, being more compact, do not have dispersed relay rooms, but the equipment and supplies can be distributed around the GIS bays. Both AIS and GIS may also have centralised D.C.systems.

Substations with Centralised D.C Systems (Figures 1 & 2)

- 1.8** Duplication shall be achieved by supplying two systems each with one D.C. supply system and one or more distribution boards to supply the complete substation

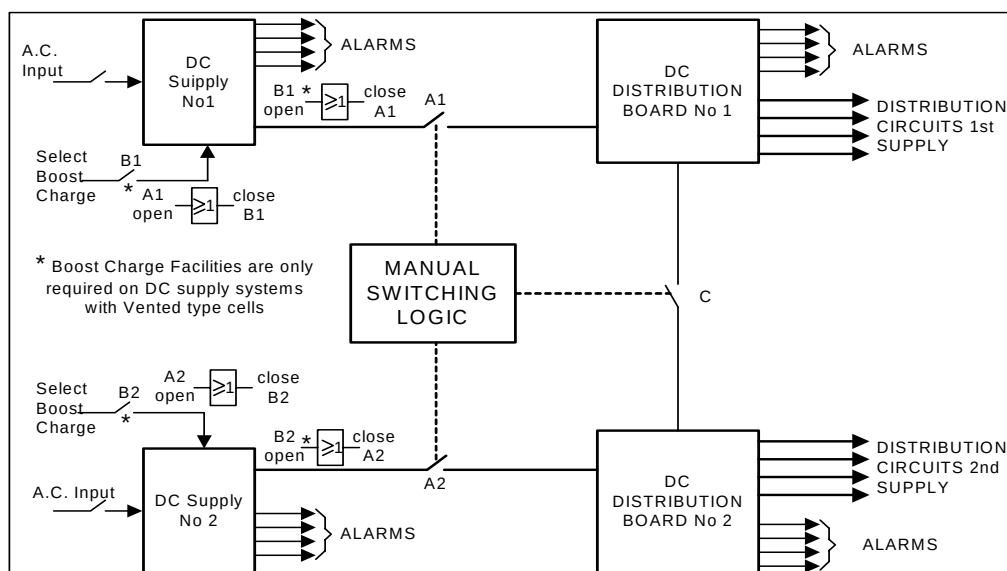


Figure 1 - Single line diagram for Centralised D.C. Systems

The individual system distribution boards shall be capable of being coupled in the event of failure of one D.C. supply system and the total substation load shall then be supplied by one D.C. supply system.

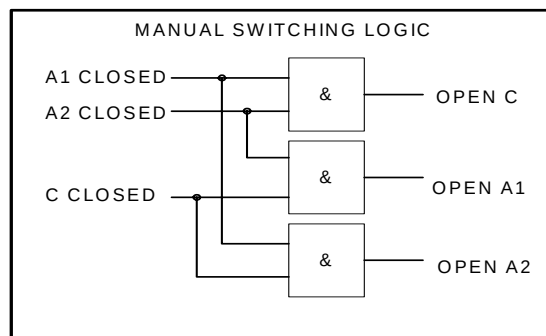


Figure 2- Manual switching logic for Centralised D.C Systems

Substations with Distributed D.C. Systems (Figure 3)

- 1.9** Where relay rooms or equipment are distributed around the site on a circuit basis, each room shall be equipped with a supply system that will normally provide the First Supply of its own circuit equipment and the Second Supply of an adjacent circuit. The load for each circuit's equipment should normally be equally shared between the First Supply and the Second Supply.
- 1.10** 48 V and 110 V D.C. centralised systems may also be used as an emergency supply for dispersed systems.

In the event of a loss of one supply system, the arrangement of the D.C. system shall be such that it is possible to re-establish full D.C. supplies in the relay room by a simple manual changeover mechanism using fuse/links from its adjacent relay room or an emergency centralised system.

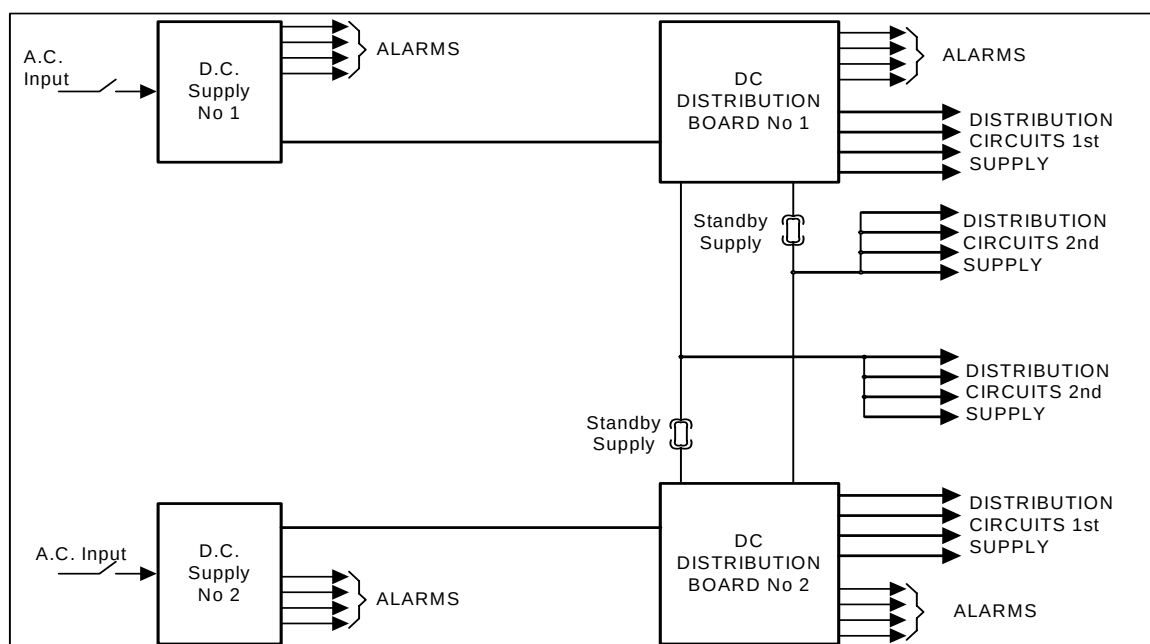


Figure 3 - Single line diagram for Distributed D.C. Systems

Supply Characteristics

- 1.11** The characteristic of the 48 V and 110 V D.C. supply system are listed in table 1 below:

	Battery & Charger D.C. Supply System			CAES D.C. Supply System			
				Full Dual or Single System		With Battery System	
D.C. Voltage	48	110		48	110	48	110
Nominal Voltage	48	110 ¹	108 ²	48	110	48	110
Normal Voltage at Distribution Board	54	125	122.6 ²	48	110	54	125/122.6 ²
Minimum voltage at Distribution Board	46			46		46	
Minimum voltage at distribution board central systems		102			102		102
Minimum voltage at distribution board distributed systems		93			93		93

Table 1

1 Equivalent to 55 Plante Cells

2 This applies to smaller capacity batteries where 6 V or 12 V monoblocs are provided eg 100 Ah or less.

2 BATTERY AND CHARGER D.C. SUPPLY SYSTEMS

2.1 Batteries

General

2.1.1 Batteries shall be of Lead Acid construction and where applicable conform to BS EN 60896-1, BS EN 60896-2, DIN 40738 or equivalent.

2.1.2 Vented (Plante) type cells shall conform to BS EN 60896-1, DIN 40738 or equivalent.

Vented type cells shall in all cases meet or exceed the performance requirements of BS 6290 Part 2.

For new installations or where a complete battery system replacement is required, the batteries used must be of the same standard.

For individual battery replacement, it is permissible to install batteries manufactured to either standard providing that:

a) The battery can be safely accommodated within the existing installation

and

b) A minimum gap of 5mm is maintained between adjacent cells.

2.1.3 VRLA cells shall conform to BS EN 60896-22 and the performance requirements of BS 6290 Part 4 to meet to the following classifications:

a) Performance Class 2 or better

b) Durability Class 3 or better

c) Safety Class 1

Supporting documentation is to be supplied, indicating classes of conformity for (a), (b) and (c) above.

2.1.4 A statement of lifetime performance of the batteries for operating conditions specified at the tender stage is to be supplied as part of the contract.

2.1.5 Each battery system shall come complete with any necessary equipment such as charge record sheets, instruction manual and advisory labels.

2.1.6 To ensure ventilation requirements can be calculated the manufacturers should provide the following information in line with BS EN 50272 -1:2010 (General Information) and BS EN 50272-2:2001 (Stationary Batteries)

Vented cells: Declared current at maximum boost voltage of 2.5v/cell using manufacturers data.

VRLA cells: Declared current which is determined from an overcharge gas emission test at 2.4 volts per cell.

- 2.1.7 Each battery shall be supplied with the necessary intercell and external connectors to the fuse boxes, etc. These connectors shall be shrouded and suitably designed for any mechanical loading.
- 2.1.8 The battery system shall be provided with isolation facilities at the input and output circuits such as fuses, links and lockable switches to enable safe working on the equipment.

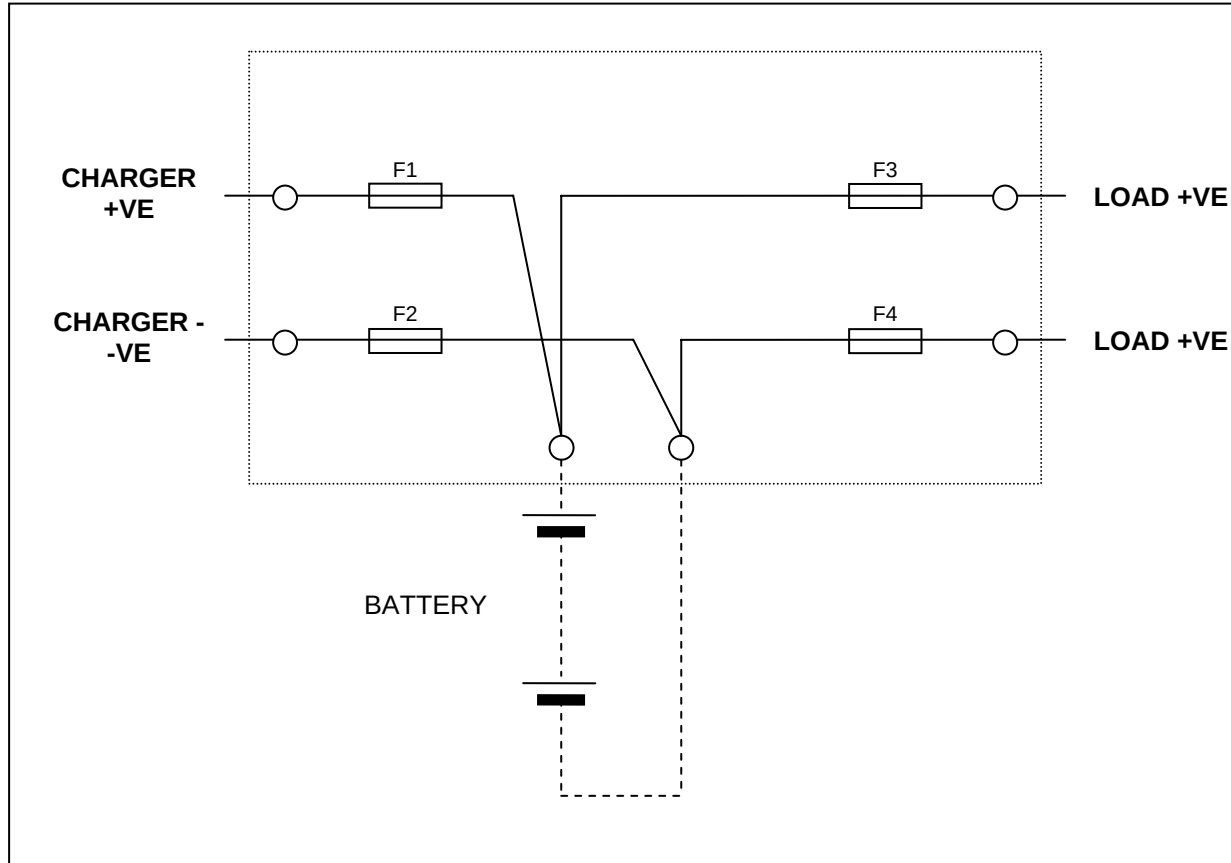


Figure 4 - Battery Isolation

- 2.1.9 For multi string batteries, isolation facilities shall also be provided for each string.
- 2.1.10 Isolation and monitoring facilities for Plante vented batteries in a battery room shall be located outside the battery room. The minimisation of the length of unprotected cable between the battery and these should be considered. These facilities shall be located adjacent the cable exit from the battery room either within the charger and distribution cubicles or separate cubicles.

Environmental

- 2.1.11 Batteries are to be recyclable and marked with the appropriate recycling symbols detailed in BS EN 61429, together with the indication "Pb" as the symbol for lead acid batteries.
- 2.1.12 Harmful substances such as Cadmium shall not be used in lead acid batteries.

Operational Requirements

Informative: The 48 Volt system will normally have a standing load associated with control and telecommunication equipment whereas the 110 Volt system will have a relatively small standing load and a short term large load requirement associated with the operation of circuit breakers etc.

2.1.13 The minimum voltage after 6 hours shall be

- a) 46 Volts for the 48 V system.
102 Volts (93 V for dispersed batteries) for the 110 V system.

Informative: The 110 Volt system shall be capable of operating any protection associated with the power supply, i.e. tripping of circuit breakers at the minimum voltage of 102 Volts (93 V for dispersed batteries). Load requirements should be made available at the tender/contract stage.

2.1.14 The battery system should be sized accordingly to meet the following:

- a) IEEE 485 standard sizing method
- b) A single 48v D.C. system shall be able to supply the full standing load for 6 hours under mains failure
- c) A distributed 48v D.C. system shall be able to supply its own standing load plus the standing load of another connected system for 6 hours under mains failure.
- d) Each system of a centralised duplicate 48v D.C. system shall be able to supply the standing loads of both systems for 6 hours under mains failure.
- e) A single 110v D.C. system shall be able to supply the full standing load for 6 hours under mains failure. During this discharge period the system shall be capable of operating all associated circuit breakers.
- f) A distributed 110v D.C. system shall be able to supply its own standing load plus the standing load of another connected system for 6 hours under mains failure. During this discharge period the system shall be capable of operating all associated circuit breakers plus all circuit breakers associated with a connected system.
- g) Each system of a centralised duplicated 110v D.C. system shall be able to supply the standing load of both systems for 6 hours under mains failure. During the discharge period the system shall be capable of operating all circuit breaker associated to both systems.

2.2 Chargers

General

- 2.2.1 Chargers shall be operated from 230 V A.C. 50 Hz single phase supply or 400 V A.C. 50 Hz 3 phase supply.
- 2.2.2 Chargers shall be constant voltage float chargers with a facility provided to enable the float voltage to be adjusted under maintenance and test conditions.
- 2.2.3 The charger control design shall be inherently current limiting. It shall be rated to supply the required standing load on the system plus an allowance as recommended by the battery supplier that provides a suitable charge rate for all conditions dependant on battery type.