



Electricity Specification 331

Issue 3

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48V Battery and Charging Equipment

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Approved for issue by the Technical Policy Panel

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Issue and Amendment Summary

Amendment No. Date	Brief Description and Amending Action
0 27/04/89	Issue 1 First Issue Prepared by: E Hamilton
1 21/05/99	Issue 1 Updated to 24 hour capacity battery and charger. CAD version of diagram. Electronic version created. Prepared by: S Rushton
0 16/01/08	Issue 2 Amended to incorporate new technical requirements, including the addition of a section on high resilience batteries. Updated to latest document format. Prepared by: S Stelfox Approved by the Technical Policy Panel and signed on its behalf by:
1 12/09/08	Issue 2 Definitions added. Black start requirements defined Removal of reference to sealed batteries. Additional requirement to allow for charge removal for maintenance purposes. Additional requirement for installation of battery alarm. Prepared by: G Bryson Approved by the Technical Policy Panel and signed on its behalf by:
0 26/11/14	Issue 3 Updated to latest specification template. Major rewrite to incorporate modular battery, charger and distribution board elements. Specification widened and generalised to allow a variety of offerings from manufacturers. Prepared by: S Rushton Approved by the Technical Policy Panel and signed on its behalf by:

48V BATTERY AND CHARGING EQUIPMENT

1. SCOPE

This specification defines the requirements of 48V (nominal) battery and charging equipment and all necessary interconnections which shall be used for the purpose of providing power supplies to telecontrol, intertripping, automation and telecommunications equipment associated with the distribution network owned by Electricity North West Limited, hereinafter referred to as Electricity North West.

This specification has been amended to reflect the increasing requirement for 48V supplies within substations. These increased requirements are brought about by the installation of additional telecommunications equipment within substations. This specification details the increased capacity necessary to meet these requirements.

The specification covers a standard 48V battery providing either 24, 48 or 72hr standby capability following loss of ac supply. The capability required will be site specific depending on the equipment installed, location on the network and whether it is defined as a "black start" site which will require additional capacity to give a 72hr standby capacity.

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Valve regulated batteries only are specified. The total equipment comprises a wall or floor mounted charger unit and separate sealed cell monobloc units. Tenderers shall complete the clause conformance sheets in Appendix B.

2. DEFINITIONS

Approval:	Sanction by the Electricity North West Protection Systems Manager that specified criteria have been satisfied.
Contract:	The agreement between Electricity North West and the Contractor for the execution of the Works including therein all documents to which reference may properly be made in order to ascertain the rights and obligations of the parties under the said agreement.
Contractor:	The person or person's firm or company, including personal representatives, successors and permitted assigns, whose tender has been accepted by Electricity North West.
Specification:	The Specifications and schedules (if any) agreed by the parties for the purpose of the Contract.
Sub-Contractor:	Any person (other than the Contractor) named in the Contract for any part of the Works or any person to whom any part of the Contract has been sub-let with the consent in writing of the Electricity North West Protection Systems Manager, and the legal representatives, successors and assigns of such person.
Supplier:	Any person or person's firm or company who supplies goods to Electricity North West or to its contractor.
Tender:	An offer in writing to execute work or supply goods at a fixed price.
Tenderer:	The person or person's firm or company, including personal representatives, successors and permitted assigns, invited by Electricity North West to submit a tender.

3. GENERAL REQUIREMENTS FOR APPROVALS AND TESTING

3.1 Product not to be changed

No change in the product, packaging or labelling shall be made after Approval has been granted without prior notice to the Electricity North West Protection Systems Manager, and receipt of a written agreement to the proposed change from the Electricity North West Protection Systems Manager.

3.2 Electricity North West Technical Approval

3.2.1 The Tenderer shall submit, with this Tender, proposals for testing which will demonstrate, to the satisfaction of the Electricity North West Protection Systems Manager, compliance with this Specification. Such tests shall be carried out without expense to Electricity North West.

3.2.2 Alternatively, the Tenderer may submit technical reports and other data that he considers will demonstrate, to the satisfaction of the Electricity North West Protection Systems Manager, compliance with this specification. Acceptance of this evidence shall be at the discretion of the Electricity North West Protection Systems Manager but will not be unreasonably withheld.

3.2.3 Approval shall be 'factory specific' and is not transferable to another factory without the written approval of the Electricity North West Protection Systems Manager.

3.2.4 The supplier and product shall comply with all the relevant requirements of Electricity North West documents EPD311 and CP311.

3.2.5 Existing approved equipment is listed in appendix C. Proposed new equipment will be considered for approval in accordance with this specification.

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3.3 Quality Assurance

3.3.1 The Tenderer shall confirm whether or not approval is held in accordance with a Quality Assurance Scheme accredited under ISO 9000. If not, he shall submit a statement of the quality assurance procedures employed to control the quality of the product, including the performance of Suppliers and Sub-Contractors.

3.3.2 The right is reserved for the Electricity North West Protection Systems Manager to require, from time to time, the repeat of such tests as he may deem to be reasonably necessary to demonstrate continued compliance with the Specification.

3.3.3 The Tenderer shall submit, with his Tender, a list of tests and inspections which are carried out on the product prior to despatch which shall demonstrate, to the satisfaction of the Electricity North West Protection Systems Manager, fitness for installation and service.

3.3.4 The Tenderer shall provide free of charge to Electricity North West such samples as may, in the opinion of the Electricity North West Protection Systems Manager, be reasonably required for inspection and/or retention as quality control samples. The Electricity North West Protection Systems Manager will confirm the requirement for samples at the time of Tendering.

3.3.5 The right is reserved for the Electricity North West Protection Systems Manager to make, from time to time, such inspections of the Tenderer's facilities as he may deem to be reasonably necessary to ensure compliance with this Specification and any Contract of which it forms a part.

- 3.3.6 The Tenderer shall submit, with his Tender, such details of product packaging disposal, as will enable Electricity North West to comply with the requirements of BS EN ISO 14001: 1996 – Environmental Management Systems.

3.4 Formulation

The Tenderer shall submit, with his Tender, such details of the formulation and use of the product and associated substances as will enable Electricity North West to comply with the obligations of the Health and Safety at Work Act 1974 and the Control of Substances Hazardous to Health Regulations 2002, in the use, storage and disposal of the product. The Tenderer may stipulate, prior to submission of such information, that he requires it to remain confidential and the Electricity North West Protection Systems Manager will, if requested, confirm his agreement to this prior to receipt of the information.

3.5 Identification Markings

- 3.5.1 The Tenderer shall submit, with his Tender, details of markings which it is proposed to apply to the product or packaging to identify manufacturing batches or items. The forms and content of such markings shall be subject to the Approval of the Electricity North West Protection Systems Manager, and shall in all cases include the Electricity North West Approved Description and Commodity Code Number.

- 3.5.2 The Tenderer shall submit, with his Tender, such details of marking gross weight on components, assemblies and packages, as will enable Electricity North West to comply with the Health and Safety Manual Handling Operation Regulations 1992, for components, assemblies and packages supplied with a gross weight over 1kg. The forms and content of such markings shall be subject to the Approval of the Electricity North West Protection Systems Manager.

3.6 Minimum Life Expectancy

The minimum life expectancy of all products covered by this specification is 8 years for batteries and 25 years for all other equipment. Consideration will be given to those products that can demonstrate a longer life expectancy.

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3.7 Product Conformity

Preference will be given to those suppliers who can provide suitable Product Conformity Certification to a recognised or specified standard, or an equivalent certification.

4. REQUIREMENTS FOR TYPE AND ROUTINE TESTING.

The Electricity North West Protection Systems Manager shall set out the requirement of the following tests to be carried out by the supplier at the suppliers' cost.

4.1 Requirement for type tests at the suppliers' premises

These are a series of one-off type tests, which are carried out to ensure the satisfactory performance of the product design, under extremes of operating stresses, and of endurance, as may be appropriate, to be determined by the Electricity North West Protection Systems Manager.

These may or may not be destructive tests.

4.2 Requirement for routine tests at the suppliers' premises

These tests may be required to be carried out on every individual unit or component, as specified, or at some regular frequency to be determined by the Electricity North West Protection Systems Manager.

The results of these tests may be required to be supplied to Electricity North West with each unit purchased or retained for inspection, at a period to be determined.

5. TECHNICAL PARTICULARS

5.1 Battery Type

5.1.1 The battery shall be of a type approved by the Electricity North West Protection Systems Manager

5.1.2 Battery units shall comply with the requirements of Directive 2006/66/EC of the European Parliament and of the Council, on batteries and accumulators.

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5.1.3 Batteries shall not be approved which exceed a weight of 25kg to enable safe lifting and handling.

5.1.4 Only valve regulated maintenance free cells shall be considered.

5.2 Battery Capacity

Assuming an initial fully charged state, the standard battery shall be capable of the constant discharge shown in Table 1, unless otherwise specified.

Table 1

Discharge Rate	Duration	Minimum final cell voltage (Volts per cell)
7.5A	24, 48 or 72hrs	1.83V

5.3 Accessories and Labelling

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5.3.1 Each complete battery shall be supplied with all inter unit connections. In addition, two off 3 metre lengths of suitable double insulated leads shall be provided for connection (made by others) between the battery and charger/distribution board. The leads shall have suitable connecting lugs fitted for the battery end.

5.3.2 All terminals and interconnections shall be shrouded and shrouding should allow for it to remain intact except for sections which need to be removed to give necessary access to terminals for maintenance and/or testing.

5.3.3 The batteries shall be labelled to indicate cell number. The labelling shall be sufficient in size to be clearly visible. Labels shall be fixed when the battery is initially assembled, with numbering "1" commencing at the positive end of the battery string.

5.4 Battery Accommodation

- 5.4.1 The batteries shall be installed in a cabinet or approved open racking system. The cabinet shall be louvered to allow for natural cooling. Both options shall be included in the tender.
- 5.4.2 The battery cabinet shall be sufficiently sized to house the batteries designated by the Electricity North West Protection Systems Manager while still providing adequate space for cell testing.
- 5.4.3 Battery cabinets shall be of such a design that it is possible to attach an additional cabinet to the side to increase site capacity. This shall include provision to allow all battery cabling to be routed internally between any additional cabinets.

5.5 Charging and Distribution Equipment Enclosure

- 5.5.1 The charging and distribution equipment shall be accommodated in a separate cabinet which may be wall mounted or bolted on the battery accommodation cabinet.
- 5.5.2 The distribution board shall be easily separable from the charging equipment and expandable if required. Distribution cabinets shall be designed so that additional distribution boards can be added if required.
- 5.5.3 The distribution board and charging equipment cabinet shall be of a material and design that they provide sufficient protection, support, access, working space and ventilation for the equipment within. Additionally they shall meet all other requirements for expansion or connection to other cabinets in this specification.
- 5.5.4 Cables shall be either top or bottom entry and a multicore cable gland plate shall be fitted at a height of between 250mm and 350mm from the base. The gland plates shall be removable and undrilled.
- 5.5.5 Routine inspection and maintenance access shall be available on charger, battery & distribution cabinets.
- 5.5.6 Each cubicle shall have an earth bar of 3 x 25mm hard drawn high conductivity copper with M12 drilled connection points. Provisions shall be provided to allow inter cabinet and main substation earthing connections to these bars. The multicore cable gland plate shall be connected to this earth bar by means of 16mm² copper conductor.
- 5.5.7 Any doors fitted to the battery charger and distribution cubicles shall be hinged preferably with lift-off hinges. The doors shall be fitted with a hasp and staple to accommodate Electricity North West' standard padlocks of 7mm diameter hasp with 25mm clearance.
- 5.5.8 The enclosure shall have an IP rating of IP21.

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5.6 Temperature and Humidity Range

- 5.6.1 The charger shall be capable of operating within an ambient temperature range of -10°C to +35°C. There shall be no assisted cooling.
- 5.6.2 The charger shall be capable of operating within a humidity range of 5 to 95% relative humidity (RH) non-condensing.

5.7 Charger Input Power Supply

- 5.7.1 The mains input shall be fused in the live pole. The charger shall be able to operate with an input power supply of 216 – 253V AC 50+/- 1 Hz.
- 5.7.2 Alternative options for maintaining charging of the batteries under loss of mains will be considered. These may include renewable energy solutions such as solar arrays, wind turbines or other alternatives.

5.8 Charger Output Voltage

- 5.8.1 The charger output voltage shall have a negative temperature co-efficient of approximately 3mV per cell per °C (-0.07V/°C for 24 cell battery).
- 5.8.2 Output voltage regulation of $\pm 1\%$ shall be provided over a range of mains input variation of $\pm 10\%$ voltage and $\pm 2\%$ frequency, for 10-100% of output load variation.
- 5.8.3 A range of adjustment for output voltage shall be provided, this to be at least 48V to 60V. The unit shall be factory set at 54.5V at 20°C.
- 5.8.4 Maximum output rms ripple voltage shall not exceed 2mV CCITT telephone weighted.
- 5.8.5 Only a single mode float charge mode is required.

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5.9 Charger Output Current

- 5.9.1 The DC output current shall be able to support minimum specified standing loads but shall be limited to a maximum of 30A.
- 5.9.2 After the specified discharge period as covered in 5.2 the charger shall be capable of recovering the cells to nominal float voltage within 24 hours.
- 5.9.3 The output shall be current limited and shall be protected against overload or short circuit. Upon the removal of a short circuit or overload, the charger shall automatically assume its normal constant voltage output.
- 5.9.4 The charger shall not cause interference with radio and telephone equipment and the audible noise shall not exceed 65 dBA in operation, measured at 1m from the charger.

5.10 Charging Equipment

- 5.10.1 The charger shall be operated by a withdrawable modular control unit which can be easily replaced if the charger faults.
- 5.10.2 Chargers shall be suitable for substation environments. The chargers should not be susceptible to damage due to rise in the substation earth potential following power system earth faults.
- 5.10.3 The primary and secondary of all mains powered transformers shall have an effectively earthed screen between them. The insulation between each winding and other windings connected to the case and screens shall withstand 2kV rms ac at 50 Hz for one minute and immediately afterwards the insulation shall be not less than 20M Ω when measured at 500V dc.
- 5.10.4 The transformer tapings and the input and output terminals shall be clearly marked. They shall be mounted in an easily accessible position in the cubicle. All connections exceeding 110V ac shall be shrouded.

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5.11 Charging Equipment - Small Wiring

- 5.11.1 Small wiring shall be PVC type B to BS 6231. All insulated wire shall be a minimum of 32/0.2mm (1 mm²) except for connections to telephone type equipment for which 0.8mm wire may be used. Both ends of all wires or control cables shall be provided with a marker bearing a permanent inscription corresponding to the diagram of connections.
- 5.11.2 A charger circuit diagram and parts list shall be provided.

5.12 Maintenance Requirements

It shall be possible to disconnect, isolate and remove the charger for maintenance and/or replacement whilst the battery remains in service.

5.13 Alarms

- 5.13.1 Battery alarms shall be provided by fitting an approved unit that must indicate battery earth faults, battery high and low volts alarms, battery high impedance and charger fail.
- 5.13.2 The unit shall be connected to monitor the dc distribution board.
- 5.13.3 Low volt alarm shall be set at 51.6V (2.15V/cell). High volts alarm shall be set at 57.6V (2.4V/cell).
- 5.13.4 For each of the alarms specified in 5.14.1 a separate alarm relay with two voltage free contacts shall be provided. One output alarm relay shall provide an alarm in the event of a battery earth fault on either pole of the battery of less than 20kΩ.

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The high volts, low volts or high battery impedance alarm relays shall be normally energised and capable of being time delayed for up to 130s. All other alarms shall be initiated immediately.

- 5.13.3 An under voltage relay shall be provided connected to the main incoming ac supply. This relay shall provide a normally closed contact to give a “Main Charger Supply Fail Alarm.”

5.14 Distribution Board

- 5.14.1 Fuses of a type approved by the Electricity North West Protection Systems Manager shall be provided for all circuits, normally rated at 16A. Carriers and bases shall be of a type approved by the Electricity North West Protection Systems Manager. The fuse and link for each circuit shall be mounted adjacent to each other and shall be clearly labelled LOAD 1, LOAD 2, LOAD 3, LOAD 4, LOAD 5, LOAD 6 as shown in the diagram in appendix A.

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The ac input and dc output of the charger shall also be made using these approved carriers and bases.

- 5.14.2 The wiring, on the battery side of all fuses and to both sides of associated links, shall be as short as practicable and routed to minimise the possibility of battery faults. There shall be no wiring in the vicinity of the connections on the battery side of the main battery fuses. All wiring connections must be shrouded.
- 5.14.3 The DC output of the charging circuit shall be connected to the load side of the battery fuses.
- 5.14.3 The charger ammeter shall be connected on the charger side of the charger fuse.

5.14.4 The carriers and bases of fuses and links shall be coloured in accordance with the following code:

Table 2

<u>Function</u>	<u>Colour</u>
32A and 2A fuse	Black
16A fuse	Sea Green (No. 217 in BS381C)
Withdrawable links	White
Bolted links	Tinned copper

5.14.5 The positive pole of the dc distribution board shall be solidly earthed. Outgoing ways shall be fused in the negative pole only with links in the positive pole.

5.14.6 An example block diagram of a typical 48V battery charger and distribution board is shown in appendix A and is in Electricity North West Drawing No 900200-119.

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5.15 Instruments

5.15.1 All instruments shall be flush mounting. Ammeters shall be at $\pm 3\%$ accuracy to BS 89. Instrumentation shall be provided to indicate the charger current output.

5.15.2 A suitable 1% voltmeter scaled 0-65V having a calibrated mark at the appropriate float voltage of 54.5V is required.

5.16 Drawings and Documentation

5.16.1 The following drawings and instructions shall be provided with the tender & delivered with each unit:

- (a) General arrangement drawing – fully dimensioned including civil interface information, weights, fixing details and equipment / internal layout
- (b) Circuit Diagram
- (c) Wiring Diagram
- (d) Operation and installation instructions. These shall be of sufficient standard to allow Electricity North West to install and commission the system without assistance from the supplier
- (e) Battery Sizing Calculation

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5.16.2 Drawings shall be provided to the Electricity North West Protection Systems Manager in Autocad 2010 format and PDF. Multi sheet booklets shall not be used.

For any bespoke units preliminary versions shall be provided with the tender. Final versions shall be provided 6 weeks following receipt of an order.

6. DOCUMENTS REFERENCED

Health and Safety at Work Act 1974

Control of Substances Hazardous to Health Regulations 2002

Health and Safety Manual Handling Operation Regulations 1992

ISO 9000 - Quality Management Systems

BS EN ISO 14001: 1996 – Environmental Management Systems

BS6290 Pt 4 (1997) - Lead-acid stationary cells and batteries

BS6231 (1990) - Specification for PVC-insulated cables for switchgear and controlgear wiring

BS89 (1990) - Direct acting indicating analogue electrical measuring instruments and their accessories

BS381C - Specification of colours for identification, coding and special purposes

EPD311 - Approval of Equipment

CP311 - Equipment Approval Process

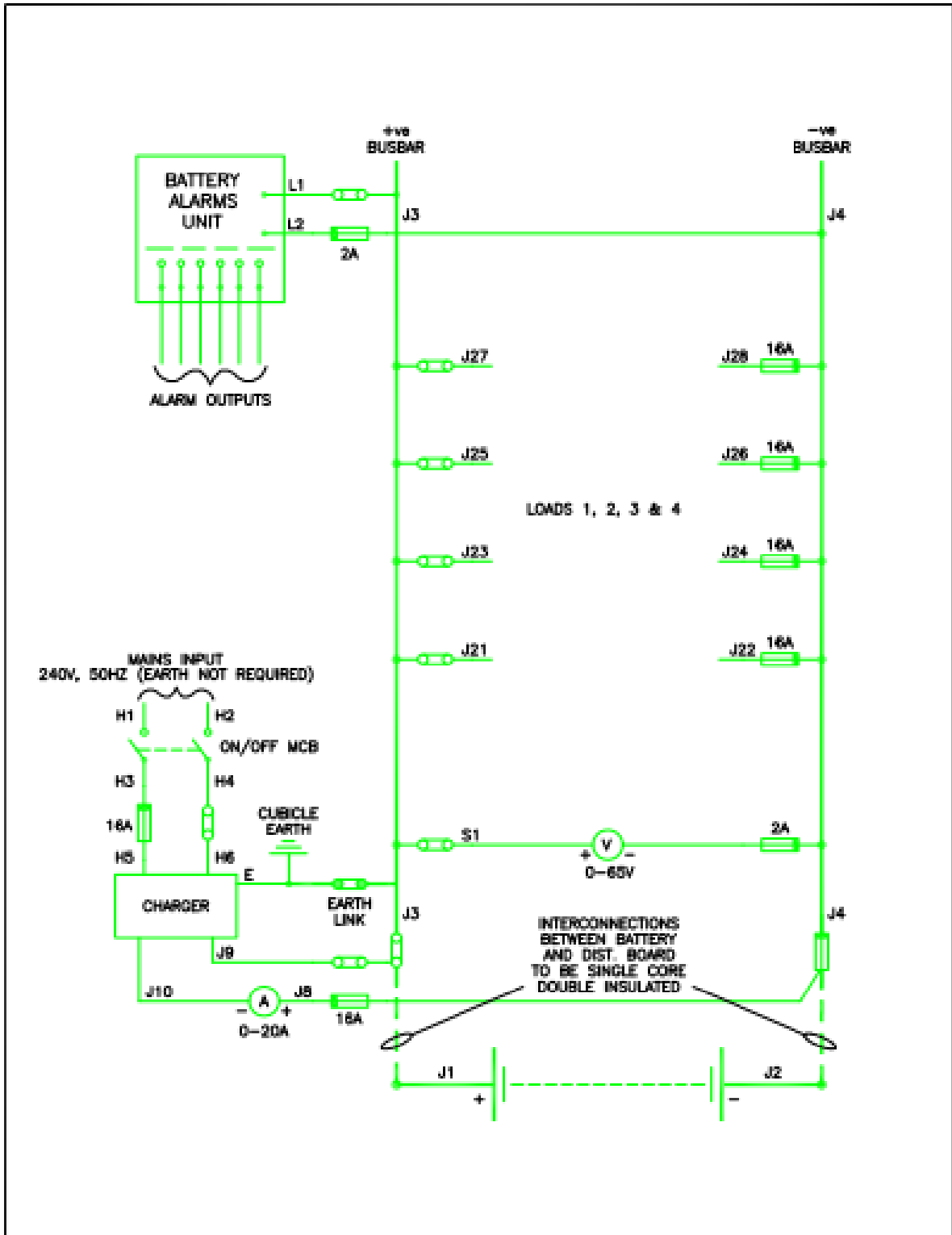
Directive 2006/66/EC of the European Parliament and of the Council of 6 September 2006 on batteries and accumulators and waste batteries and accumulators

7. KEYWORDS

Battery; Charger; Alarms; Telecontrol; Intertripping; Automation

APPENDIX A

48V BATTERY CHARGER AND DISTRIBUTION BOARD SCHEMATIC DIAGRAM



		ELECTRICITY NORTH WEST FREDERICK ROAD SALFORD M6 6QH		BLOCK DIAGRAM OF 48V BATTERY CHARGER AND DISTRIBUTION BOARD			
DRAWN	Admin	SCALE	NTS	SITE NAME	STANDARD-CIRCUIT	SCHEMATIC DIAG	
APPROVED	MIKE TURNER	DATE	22/12/1999	P.F.R. NO.	900200	DWG STATUS	Released
OLD DWG NO	09_A4_6572_0008	SHEET SIZE	A4	DWG NO	900200-119	REV	002

Clause / Sub-clause		Requirement	Conformance Code	Remarks (Must be completed if Conformance Code is not C1)
3	1	Product not to be changed		
3	2	Electricity North West Technical Approval		
3	3	Quality Assurance		
3	4	Formulation		
3	5	Identification Markings		
3	6	Minimum Life Expectancy		
3	7	Product Conformity		
4	1	Requirement for type tests at the supplier's premises		
4	2	Requirement for routine tests at the supplier's premises		
5	1	Battery Type		
5	2	Battery capacity		
5	3	Accessories and labelling		
5	4	Battery accommodation		
5	5	Charging and Distribution Equipment Enclosure		
5	6	Temperature Range		
5	7	Charger Input Power Supply		
5	8	Charger Output Voltage		
5	9	Charger Output Current		
5	10	Charging Equipment		
5	11	Charging Equipment-Small Wiring		
5	12	Maintenance Requirements		
5	13	Alarms		
5	14	Distribution board		
5	15	Instruments		
5	16	Drawings and Documentation		

Additional Notes:

APPENDIX C

CURRENTLY APPROVED EQUIPMENT TYPES

1. APPROVED EQUIPMENT

Batteries – Powersafe 12V92F

Racking – None currently approved

Battery Alarm Unit – Alstom BA300

Fuses, bases and carriers – Red Spot fuse holders

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