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NPS/003/016 – Technical Specification for 48V and 110V Battery and Charger Systems

1. Purpose

The purpose of this document is to detail the technical requirements for 48V and 110V battery and charger systems for use by Northern Powergrid (the Company).

This document supersedes the following documents, all copies of which should be removed from circulation.

Reference	Version	Date	Title
NPS/003/016	2.1	Aug 2016	Technical Specification for 48V and 110V Battery and Charger Systems

2. Scope

This specification details the technical requirement for 48V and 110V batteries and chargers for use in substations where DC supplies are required for control, protection and auxiliary functions. It includes a requirement for suppliers to provide periodic inspection and maintenance information.

It will also be necessary to consider and include any project specific requirements as detailed in Appendix 4: Addendum to Supplier Requirements.

The following appendices form part of this technical specification;

- Appendix 1: Technical Specification
- Appendix 2: Declaration of Technical Specification Sheet
- Appendix 3: Self Certification Conformance Declaration ENATS 50-18
- Appendix 4: Discharge Profiles
- Appendix 5: Schedule of Requirements
- Appendix 6: Addendum to Supplier Requirements
- Appendix 7: Pre-Commission Testing, Routine Inspection and Maintenance Requirements
- Appendix 8: Technical Information Check List

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3. Technical Requirements

3.1. Compliance with other Specifications and Standards

Where reference is made within this specification to any International Standard, British Standard, Energy Networks Association Technical Specification (ENA TS) or any other standard, this shall be to the latest version of that standard current at the time of supply.

3.2. General

This specification covers batteries, charger units and complete installations with integral charging facilities. Units with or without charging equipment will be considered depending on specific site requirements.

With consideration given to battery performance, reliability, failure modes and lifetime cost of ownership, the companies preferred battery technology for 48V and 110V installations is Gas Recombination Nickel-Cadmium (GR Ni-Cd) monobloc or single cells.

Installations at some sites, typically with EHV oil circuit breakers, demand a high tripping current (IP=262A). At these sites, the use of Vented Nickel-Cadmium cells is an acceptable compromise between marginally increased maintenance burden and reduced battery capacity (and cost) that is still capable of delivering the required current profile.

Lead-Acid battery systems remain in service at some sites from legacy installations. These remain acceptable in the short term for continued service and shall be maintained in accordance with MNT/005. When the system or a major part thereof requires replacing, a cost-benefit analysis will be undertaken to establish if repair or complete replacement is the most cost effective solution.

Whenever a battery installation is being considered or assessed for replacement on a site with multiple battery installations, consideration should be given and the possibility explored as to whether these multiple systems can be rationalised into a single cost effective installation where the plant and equipment being supplied will allow.

In the case of LJP sites (GSP, BSP or Primary), the installation shall be replaced with the preferred battery technology, currently GR Ni-Cd.

Northern Powergrid utilises a "DC Disconnect facility" to meet the requirements stated in ENA Engineering Recommendation G91 Substation Black Start Resilience. At these sites, 72 hours resilience of the closing and tripping batteries shall be achieved by disconnecting the batteries via an appropriately rated device and subsequently re-energised prior to the restoration of supplies in the event of a Black Start event. SCADA batteries shall be reinforced to provide 72 hours continuous supply to control functions. The DC Disconnect facility shall be built in as an integral function of the Battery and Charger system and shall conform to Northern Powergrid Specification NPS/003/039 – Technical specification for Substation DC Disconnection Schemes.

Where site conditions impose a constraint on available space, a popular solution adopted has been to install a system in a parallel format, thereby achieving the required capacity with a larger number of cells with smaller physical size. This is NOT a preferred arrangement and all other options shall be evaluated and considered before choosing this as a solution. Where this becomes absolutely necessary, then the system shall be supplied with an ADVANCED monitoring system fully capable of detecting and identifying individual cell failures.

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The voltage characteristics for a 48V DC system shall be as follows, with equipment energised from these supplies being capable of operating over the range of 40.8V to 60V

Nominal voltage	46.8V
Equipment normal working voltage	48V
Maximum float voltage	55.38V
Minimum voltage at distribution board	46V
Maximum charger voltage under all conditions	60V
Minimum voltage at terminals of equipment supplied by the distribution board	42V

The voltage characteristics for a 110V DC system shall be as follows, with equipment energised from these supplies being capable of operating over the range of 87.5V to 137.5V.

Nominal voltage	108V
Equipment normal working voltage	125V
Maximum float voltage	127.8V
Minimum voltage at distribution board	102V
Maximum charger voltage under all conditions	137.5V
Minimum voltage at terminals of equipment supplied by the distribution board	93V

Tripping batteries on Primary substation sites shall be sufficient to provide a 6 hour discharge profile and Tripping batteries on GSP (Grid Supply Points) and BSP (Bulk Supply points) shall be sufficient to provide a 24 hour discharge profile conforming to that provided in Appendix 4 of this specification.

The equipment shall comply with the current editions of BS EN 60086, BS EN 60896-21, BS EN 60896-22, ENATS 50-18 and either BS EN 60622 or BS EN 60623, except where varied by this specification, and with Appendices 1, 2 and 4 of this specification.

Equipment supplied shall comply with the specification in Appendix 1.

The technical specification of any system must be declared using the tables in Appendix 3.

3.3. Battery Charger

- 3.3.1. Battery Chargers shall be operated from a 230V single phase or 415V 3 phase 50 Hz AC supply from a dedicated output from the substation LVAC distribution board.
- 3.3.2. The AC input is to be connected to the system via a Surge Protection Device (SPD) to BS EN 61643-11 that will protect the DC system against surge conditions on the AC supply.
- 3.3.3. Where the Battery Charger is being installed or replaced as part of NEW substation installation OR a FULL REFURBISHMENT of a substation, then they shall be TYPE 2 – Permanently connected, installed on the LOAD side of the Service Equipment over current device.
- 3.3.4. Where the Battery Charger / Battery System only is being replaced AND no TYPE 2 SPD is installed, then the SPD will be TYPE 3 – Point of utilization installed at the equipment being protected.
- 3.3.5. Chargers shall be suited to the battery cell technology being provided or in use. Typically this will be a 2 rate constant voltage float type with a facility to set both Boost and Float levels in line with the Battery Manufacturers recommendations to maximise battery life. A facility shall also be provided to enable this level to be adjusted under maintenance and test conditions. The charging level and range shall be designed to suit the battery.
- 3.3.6. Chargers shall be automatically temperature compensated to provide the required performance over the expected temperature range (0°C - 40°C).
- 3.3.7. Battery Chargers shall be rated to supply the required standing load on the system plus an allowance as recommended by the battery supplier to provide a suitable charge rate for all conditions.

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- 3.3.8. The charger control design shall have current limiting facilities to suit its rating. This limit should not allow damage to the battery due to fast charge rates. The current limit performance of the charger shall be 2% of nominal setting over the voltage range of the cells.
- 3.3.9. The charging voltage will not vary by more than 2% over 0 – 10% of charging load, and 1% over 10-100% of charging load despite variations in input voltage of +10% -6%.
- 3.3.10. A voltmeter with an accuracy Class 0.2 to BS EN 60051-1, IEC 60051-1 shall be used for setting up.
- 3.3.11. The charger shall be capable of meeting its output requirements when it is fed from an A.C. main of low impedance with a frequency between 47 Hz and 52 Hz.
- 3.3.12. The charger output superimposed ripple shall not exceed the battery supplier's recommendations.
- 3.3.13. Charger transformers shall comply with ENATS 50-18 for the required duty and temperature limits under all conditions.
- 3.3.14. The insulation between each winding, screen, core and frame and all other circuits on the system directly connected to the 230V A.C. or 415V A.C. or 110V DC system shall withstand 2 kV A.C. (RMS) at 50 Hz for one minute between the appropriate terminal and earth and between all terminals of electricity separate circuits. The resistance measured at 500V DC after this test shall not be less than 20 mΩ between any terminal and earth or between terminals of electrically separate circuits.
- 3.3.15. The charger shall not produce interference on the A.C. input in excess of that specified in EA Engineering Recommendation G5 issue 5 *"Harmonic voltage distortion and the connection of harmonic sources and/or resonant plant to transmission systems and distribution networks in the United Kingdom"*
- 3.3.16. Switched Mode Power Supplies are acceptable where they conform to applicable standards under the Electromagnetic Compatibility (EMC) Regulations 2016 and such evidence is provided.
- 3.3.17. The AC input to the charger shall be suitably fused and also provided with a double pole isolating switch. The fuse should be of sufficient rating to avoid operation by the magnetising inrush of the transformer.

3.4. Cubicle

- 3.4.1. Equipment shall be housed in lockable sheet steel cubicle complying generally with the requirements of ENATS 50-18 *"Application of Ancillary Electrical Equipment"*. The cells and battery charger, where provided shall be contained in separate compartments.
- 3.4.2. The cubicle shall be so designed and constructed as to provide minimum ingress protection to classification IP32 in accordance with BS EN60529.
- 3.4.3. The cabinet shall be capable of being mounted on steel channels which run across an open trench.
- 3.4.4. The cubicle shall house the cells and charging unit, where supplied, within their separate compartments in such a way that they can be maintained, removed and replaced individually without having to remove the cabinet from its installed location. In all cases the battery cell arrangement shall not exceed a formation of two rows in order that individual cells can easily be accessed for removal and replacement AND an unobstructed view of electrolyte MIN /MAX levels can be observed. Access to individual cell terminations and vents shall be sufficient to facilitate checking of the battery condition whilst in service. Any sheet steel cabinet panels shall be attached in such a way that they can be removed from the outside with no possibility of any fastenings falling inside the cabinet.
- 3.4.5. The cubicle door shall be fitted with a handle which can be secured in the closed position by means of a padlock having a nominal hasp diameter of 8 mm.
- 3.4.6. Internal wiring shall be ENATS 50-18 compliant and where this is taken through steel panels shall be suitably and sufficiently protected.

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- 3.4.7. As a minimum, two 20 mm access holes shall be provided in the side of the cubicle to facilitate external input and output wiring connections. Where these main connections are via a steel gland plate within the floor of the cubicle, this gland plate shall be a split design so that they can be removed without disturbing glanded cables.
- 3.4.8. Suitable provision shall be made for earthing of the unit.
- 3.4.9. Connecting links and terminations to and from and between battery cells shall be suitably shrouded to limit and reduce the amount of exposed current carrying conductor.
- 3.4.10. Adequate and suitable ventilation shall be provided:-
- (a) to limit any temperature rise within the cubicle to a level which will not be detrimental to either the life or performance of the cells or any other components of the equipment, and
 - (b) to prevent the build-up of any gasses which may be produced within the unit under fault conditions.
- 3.4.11. The cubicle shall be polyester powder coated with a light colour, preferably grey on the outside and white on the inside.

3.5. System Monitoring

- 3.5.1. A voltmeter shall be provided to measure the battery output voltage with the charger disconnected. This shall be operated by a switch with an auto return to the off position
- 3.5.2. An ammeter shall be provided to measure the charger output. These instruments shall be to EATS 50-18 and IEC 51 Class 1.
- 3.5.3. An alarm module shall be provided to monitor the DC system and shall provide the following local alarms with a corresponding No-volt contact for remote purposes:

Alarm Module Local Indication	110V	48V	Remote Indication Group
High voltage alarm	132V	58V	Urgent
Low voltage alarm	117V	51V	Urgent
Charger fail alarm			Urgent
Battery high resistance or open circuit			Urgent
Battery earth fault alarm	50 kΩ	50 kΩ	Non urgent

- 3.5.4. The settings and range of the above shall take account of hysteresis, maximum and minimum conditions and situations when systems are coupled.
- 3.5.5. The battery earth fault detector shall provide an alarm when the insulation resistance of the substation wiring connected to either pole of the system falls to 50 kΩ. This shall apply at all voltages over the working range. With one pole of the battery system connected to earth, the fault current shall not exceed 5 mA at the maximum voltage.
- 3.5.6. A battery discharge test facility shall be provided incorporating a return to off position on/off switch and discharge resistor (with associated contactor if required). The resistor value shall be selected to give a discharge test at the 1 hour rate. A label shall be fitted adjacent to the test switch to indicate that the switch should not be operated for longer than 10 seconds.

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4. References

4.1. External Documentation

Reference	Title
	Electromagnetic Compatibility (EMC) Regulations 2016
BS EN 60051-1:2017, IEC 60051-1:1997	Direct acting indicating analogue electrical measuring instruments and their accessories. Definitions and general requirements common to all parts
BS EN 60529	Degrees of protection provided by enclosures (IP code)
BS EN 60622	Secondary cells and batteries containing alkaline or other non-acid electrolytes – sealed nickel cadmium prismatic rechargeable single cells
BS EN 60623	Secondary cells and batteries containing alkaline or other non-acid electrolytes. Vented nickel-cadmium prismatic rechargeable single cells
BS EN 60896-21	Stationary lead-acid batteries Part 21: Valve regulated types – Methods of test
BS EN 60896-22	Stationary lead-acid batteries Part 22: Valve regulated types – Requirements
BS EN 61643-11	Surge protective devices connected to low-voltage power systems. Requirements and test methods
ENA ER G91	Substation Black Start Resilience
ENA G5 Issue 5	Harmonic voltage distortion and the connection of harmonic sources and/or resonant plant to transmission systems and distribution networks in the United Kingdom
ENATS 50-18	Design and application of ancillary equipment
IEC 60623	Vented nickel cadmium prismatic rechargeable single cells

4.2. Internal Documentation

Reference	Title
MNT/005	Policy for the Inspection and Maintenance of Ground Mounted Plant and Switchgear
NPS/003/039	Technical specification for Substation DC Disconnection Schemes

4.3. Amendments from Previous Version

Reference	Title
	Whole Document Review

5. Definitions

Term	Definition
Black Start	The process of recovering from a shutdown of the entire GB electricity network
BSP	Bulk Supply Point
EHV	Extra High Voltage (33kV and above)
GR Ni-Cd	Gas Recombination Nickel-Cadmium
GSP	Grid Supply Point
IP	Peak current (Amps)
Local Joint Restoration Plan (LJRP) Site	A Primary, AND/OR a Bulk Supply Point, AND/OR a Grid Supply Substation
SCADA	Supervisory Control and Data Acquisition
SPD	Surge Protection Device
The Company	Northern Powergrid

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6. Authority for Issue

6.1. CDS Assurance

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

		Date
Liz Beat	Governance Administrator	23/01/2024

6.2. Author

I sign to confirm that I have completed and checked this document and I am satisfied with its content and submit it for approval and authorisation.

Review Period - This document should be reviewed within the following time period.

Standard CDS review of 3 years	Non Standard Review Period & Reason	
No	Period: 5 Years	Reason: Update will be dictated by contract renewal date or any significant changes in the specification or documents referenced
Should this document be displayed on the Northern Powergrid external website?		Yes
		Date
Paul McAdoo	Lead Policy & Standards Engineer	26/02/2024

6.3. Technical Assurance

I sign to confirm that I am satisfied with all aspects of the content and preparation of this document and submit it for approval and authorisation.

		Date
Alan Macdonald	Policy & Standards Engineer	26/02/2024
Michael Crowe	Protection Manager	26/02/2024
Andrew Scott	Protection Manager	26/02/2024

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	Head of System Engineering	26/02/2024

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Appendix 1 – Technical Specification for 48V and 110V Battery Systems

	ALL SYSTEMS	110V	48V
System Output Characteristics			
Nominal voltage		108V	46.8V
Float voltage (max acceptable)		127.8V	55.38V
Minimum voltage after specified discharge profile		102V	44.5V
Maximum charger voltage under all conditions		137.5V	62.5V
DC Disconnect Facility	Integrated DC disconnect function to conform with NPS/003/039 OR compatible with a retrofit system conforming to the same.		
Battery			
Standard	BS EN 60623 / BS EN 60622 / BS EN 60896 21 & 22		
Type	Low maintenance gas-recombination Nickel Cadmium OR Vented Nickel-Cadmium (Existing sites only) OR Lead-Acid (Existing Sites only)		
Design life	20 years		
Battery size	To meet the discharge profile specified in Clause 3.4 of NSP007014 and Appendix 4		
Ageing factor	NiCd 1.1 / VRLA 1.25		
Minimum topping-up period	10 years		
Minimum number of cells in battery		90	39
Maximum float voltage per cell		1.42V	1.42V
Rated temperature	15°C		
Temperature range	0°C – 40°C		
Mounting	Cubicle		
Connectors	Shrouded		
Isolation facilities required	From charger and distribution board		
Battery earthing	The battery shall be unearthed		
Charger Supply			
AC Supply	230V AC single phase or 415V AC 3 phase. +10% / -6%		
Nominal supply frequency	50Hz		
Supply frequency range	47-52Hz		
Surge Protection	Type 2 or Type 3 depending on situation		
Charger			
EMC Compatibility	Electromagnetic Compatibility (EMC) Regulations 2005		
Type	Constant voltage, two-stage, temperature compensated		
Ambient temperature range	0°C - 40°C		
Maximum Float Voltage		127.8V	55.38V
Maximum voltage under all conditions		137.5V	60V
Voltage adjustment facility	Float and boost voltages should be adjustable however such controls should not be on the front facia.		
Rated charging current	To cover standing load as specified in Appendix 3 plus adequate charging current		
Normal float charge	50% rated load at rated input voltage.		

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Variation in charging voltage as input voltage varies over range of +10% - 6% of rated value:			
Across load range 0 – 10%	Maximum 2% variation in output voltage		
Across load range 10% - Full Load	Maximum 1% variation in output voltage		
Variation in current limit over the specified voltage range of the battery.	Maximum 2% of the nominal setting		
Frequency range over which charger performance should be met.	47-52Hz		
Max earth current with one pole of battery earthed (at maximum battery voltage)	5mA		
Transformer screening	Earth metal screen between primary and secondary windings.		
System Monitoring			
High voltage alarm	Local indication plus spare contact	132V	57.6V
Low voltage alarm	Local indication plus spare contact	117V	51V
Charger fail alarm	Local indication plus spare contact		
Battery earth fault alarm	Local indication plus spare contact	50kΩ	50kΩ
Battery high resistance or open circuit	Local indication plus spare contact		
Monitoring alarm protection	2A HRC fuse		
DC Disconnect Functions	As per clause 3.3 of NPS/003/039		
Battery earth fault alarm test facility			
Test resistor value	10% below sensitivity of the earth fault relay		
Operating switch	A “return-to-off” on/off switch		
Discharge Test Facility			
Discharge resistor	To give one hour discharge rate		
Operating method	Via a “return-to-off” on/off switch, and contactor.		
Warning label	“This switch shall not be operated for longer than 10 seconds”		
Instruments			
Battery output voltmeter	Push-button or self-return-switch operated		
Charger output ammeter			
Optional DC output ammeter	0-100mV/A output		
DC Disconnect Function - Relays	As per clause 3.2.2 of NPS/003/039		
DC Disconnect Function – Manual Bypass Switch	As per clause 3.2.4 of NPS/003/039		
DC Disconnect Function - Selector Switch	Local / Remote as per clause 3.2.5 of NPS/003/039		
Cubicles and Battery Stands			
Design	Supplier to provide drawings		
Design life	40 years		
Cubicle cable entry	Bottom		
Cubicle Colour	EXTERNAL -light colour, preferably grey, INTERNAL - white		
Exposed conductors	Shrouded		
Doors	Lockable		

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Distribution Board			
General arrangement	To be specified in supplied drawings		
Number of ways	As specified in Appendix 3		
Rating of ways	16A or 32A as specified in Appendix 3		
Labels	To be specified in supplied drawings		
Distribution Output Isolation			
Fuse	Cartridge type: HD60269-2		
DC Disconnect Function	As per clause 3.2.3 of NPS/003/039		

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Appendix 2 – Declaration of technical specification of 48V and 110V Battery Systems

	UNIT	ALL SYSTEMS	110V	48V
System Output Characteristics				
Nominal voltage	V			
Float voltage (max acceptable)	V			
Minimum voltage after specified discharge profile	V			
Maximum charger voltage under all conditions	V			
DC Disconnect Function – Integrated or compatible				
Battery				
Standard	BS/IEC?			
Type of cells				
Design life	Years			
Aging factor applied				
Minimum topping-up period	Years			
Number of cells in battery	No.			
Float voltage per cell	V			
Rated temperature	°C			
Temperature range	°C			
Cell mounting: Cubicle? Tiered?	State			
Connectors: Shrouded?				
Isolation from both dist. board and charger?				
Battery earthing: Unearthed?				
Charger Supply				
AC Supply	V + 0			
Nominal supply frequency	Hz			
Supply frequency range	Hz-Hz			
Surge Protection - State Type and Provide details of Device				
Charger				
Type				
Ambient temperature range	°C - °C			
Maximum Float Voltage	V			
Boost voltage	V			
Voltage adjustment facility: Float and boost	Y/N			
Rated charging current	A			
Normal float charge	A			
Variation in charging voltage as input voltage varies over range of +10% -6% of rated value:				
Across load range 0 – 10%	%			
Across load range 10% - Full Load	%			
Variation in current limit over the specified voltage range of the battery.	%			

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Frequency range over which charger performance should be met.	Hz - Hz			
Max earth current with one pole of battery earthed (at maximum battery voltage)	mA			
Transformer screened as per specification?	Y/N			
System Monitoring				
High voltage alarm setting	V			
Low voltage alarm setting	V			
Charger fail alarm	V			
Battery earth fault alarm	kΩ			
Battery high resistance or open circuit	Yes/No			
SPD fault alarm (where Type 3 is installed only)	Yes/No			
All alarms have local indication?	Yes/No			
Contacts for remote alarm: Individual/Common?				
Alarm circuit fuse rating	A			
DC Disconnect Function	Yes /No			
Battery earth fault alarm test facility				
Is this provided?	Yes/No			
% rating against E/F relay sensitivity	%			
Discharge Test Facility				
Is this provided?	Yes/No			
Discharge rate				
Operating method				
Warning label provided?	Yes/No			
Instruments				
Battery output voltmeter	Yes/No			
Charger output ammeter	Yes/No			
DC output ammeter (option)	Yes/No			
DC Disconnect Function - Relays	Yes/No			
DC Disconnect Function – Manual Bypass Switch	Yes/No			
DC Disconnect Function - Selector Switch	Yes/No			
Cubicles and Battery Stands				
Design life	Years			
Cubicle cable entry position				
Cubicle Colour				
Exposed conductors shrouded	Yes/No			
Doors lockable	Yes/No			
Distribution Board				
Number of ways				
Rating of ways				
Distribution Output Isolation				
Type				
AC interrupting current	kA			
DC Disconnect Function - Type				

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Appendix 3 – SELF CERTIFICATION CONFORMANCE DECLARATION

48V and 110V Battery and Charger Systems required to be supplied against this specification shall comply with the latest issues of the relevant ENATS, British and International Standards specified. The following tables are intended to amplify and/or clarify the requirements of elements of these Standards but do not preclude meeting all requirements of the standards. .

The manufacturer shall declare conformance or otherwise, clause by clause, using the following levels of conformance declaration codes.

Conformance declaration codes

N/A = Clause is not applicable/ appropriate to the product

Cs1 = The product conforms fully with the requirements of this clause

Cs2 = The product conforms partially with the requirements of this clause

Cs3 = The product does not conform to the requirements of this clause

Cs4 = The product does not currently conform to the requirements of this clause, but the manufacturer proposes to modify and test the product in order to conform.

Instructions for completion

- When Cs1 code is entered no remark is necessary.
- When any other code is entered the reason for non-conformance shall be entered.
- Prefix each remark with the relevant 'BS EN' 'IEC' or 'ENATS' as appropriate.

Manufacturer:

Product Reference:

Details of the product

Name:

Signature:

Date:

NOTE:

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TECHNICAL SPECIFICATION FOR 48V BATTERY AND CHARGER SYSTEMS				
		Clause / Requirements	Conformance Code	Remarks / Comments
System Output Characteristics				
	Nominal voltage	46.8V		
	Float voltage (max acceptable)	55.38V		
	Minimum voltage after specified discharge profile	44.5V		
	Maximum charger voltage under all conditions	60V		
	Maximum open circuit voltage	State		
	DC Disconnect Function	NPS/003/039		
Battery				
	Standard	State (BS/IEC?)		
	Type of cells	State		
	Service life	20 Years		
	Aging factor applied	1.1 or 1.25		
	Minimum topping-up period	N/A		
	Number of cells in battery (minimum)	39		
	Float voltage per cell (maximum)	1.42		
	Rated temperature	15 °C		
	Temperature range	0 / +40 °C		
	Cell mounting: Cubicle? Tiered?	State		
	Connectors	Shrouded		
	Isolatable from both dist. board and charger	Required		
	Battery Earthing	Unearthed		
	Test Facility	Required		
	Auto Battery Disconnect	State		

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TECHNICAL SPECIFICATION FOR 48V BATTERY AND CHARGER SYSTEMS				
		Clause / Requirements	Conformance Code	Remarks / Comments
Charger Supply				
	AC Supply	230V / 1 Phase		
	Nominal supply frequency	50Hz		
	Supply frequency range	47-52Hz		
	Surge Protection (Type including details)	Type 2 or Type 3		
Charger				
	Type	State		
	Ambient temperature range	0 / +40 °C		
	Maximum Float Voltage	55.38 V		
	Maximum Voltage	60V		
	Voltage adjustment facility (float and boost - located behind fascia).	Required		
	Rated charging current	Charging current + 1A		
	Normal float charge	0.5A at rated input voltage		
	Variation in charging voltage as input voltage varies over range of +10% -6% of rated value: Across load range 0 – 10% Across load range 10% - Full Load	Max 2 % Max 1%		
	Variation in current limit over the specified voltage range of the battery.	Max 2% of nominal		
	Frequency range over which charger performance should be met.	47-52Hz		
	Max earth current with one pole of battery earthed (at maximum battery voltage)	5 mA		
	Transformer screened as per specification	Required		
	Secondary Wiring	ENATS 50-18		
		Clause / Requirements	Conformance Code	Remarks / Comments
System Monitoring				

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High voltage alarm setting (adjustable)	58V Local+Contact *		
Low voltage alarm setting (adjustable)	51V Local+Contact *		
Charger fail alarm	Local+Contact *		
Battery earth fault alarm	50kΩ Local+Contact *		
Battery high resistance or open circuit	Local+Contact *		
Facility for remote alarm common alarm	Local+Contact *		
Alarm circuit fuse rating	2 A		
Battery Damage (Auto Disconnect / Restore)	Auto Disconnect		
DC Disconnect Function	NPS/003/039		
Battery earth fault alarm test facility			
Operating Method	“return to off” type switch		
Test Resistor (% below sensitivity of E/F relay)	10%		
Instruments			
Battery output voltmeter	Push or self-reset switch		
Charger output ammeter	Required		
DC output ammeter	Option (0-100mV/A)		
DC Disconnect Function - Relays	NPS/003/039		
DC Disconnect Function – Manual Bypass Switch	NPS/003/039		
DC Disconnect Function – Local/Remote Selector	NPS/003/039		
Cubicles and Battery Stands			
Design life	40 Years		
Cubicle cable entry position	Bottom		
Cubicle Colour	EXTERNAL -light colour, preferably grey, INTERNAL - white		
Exposed Conductors	Shrouded		
Doors	Lockable		

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	Dimensions	As per site requirements		
	Distribution Board			
	Number of ways	16A or 32A As per site requirements		
	Rating of ways	As per site requirements		
	Distribution Output Isolation			
	Fuse	HD60269-2		
	DC Disconnect Function	NPS/003/039		

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TECHNICAL SPECIFICATION FOR 110V BATTERY AND CHARGER SYSTEMS				
		Clause / Requirements	Conformance Code	Remarks / Comments
System Output Characteristics				
	Nominal voltage	108V		
	Float voltage (max acceptable)	127.8V		
	Minimum voltage after specified discharge profile	102V		
	Maximum charger voltage under all conditions	137.5V		
	Maximum open circuit voltage	State		
	DC Disconnect Function	NPS/003/039		
Battery				
	Standard	State (BS/IEC?)		
	Type of cells	State		
	Service life	20 Years		
	Aging factor applied	1.1 OR 1.25		
	Minimum topping-up period	N/A		
	Number of cells in battery (minimum)	90		
	Float voltage per cell	State (V)		
	Rated temperature	15 °C		
	Temperature range	0 / +40 °C		
	Cell mounting: Cubicle? Tiered?	State		
	Connectors	Shrouded		
	Isolatable from both dist. board and charger	Required		
	Battery Earthing	Unearthed		
	Test Facility	Required		
	Auto Battery Disconnect	State		

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TECHNICAL SPECIFICATION FOR 110V BATTERY AND CHARGER SYSTEMS				
		Clause / Requirements	Conformance Code	Remarks / Comments
	Charger Supply			
	AC Supply	230V / 1 Phase		
	Nominal supply frequency	50Hz		
	Supply frequency range	47-52Hz		
	Surge Protection (Type including details)	Type 2 or Type 3		
	Charger			
	Type	Constant Voltage		
	Ambient temperature range	0 / +40 °C		
	Maximum Float Voltage	127.5 V		
	Maximum Voltage	137.5V		
	Voltage adjustment facility (float and boost - located behind fascia).	Required		
	Rated charging current	Charging current + 1A		
	Normal float charge	0.5A at rated input voltage		
	Variation in charging voltage as input voltage varies over range of -10% + 6% of rated value: Across load range 0 – 10% Across load range 10% - Full Load	Max 2 % Max 1%		
	Variation in current limit over the specified voltage range of the battery.	Max 2% of nominal		
	Frequency range over which charger performance should be met.	47-52Hz		
	Max earth current with one pole of battery earthed (at maximum battery voltage)	5 mA		
	Transformer screened as per specification	Required		
	Secondary Wiring	ENATS 50-18		
TECHNICAL SPECIFICATION FOR 110V BATTERY AND CHARGER SYSTEMS				
		Clause / Requirements	Conformance Code	Remarks / Comments
	System Monitoring			

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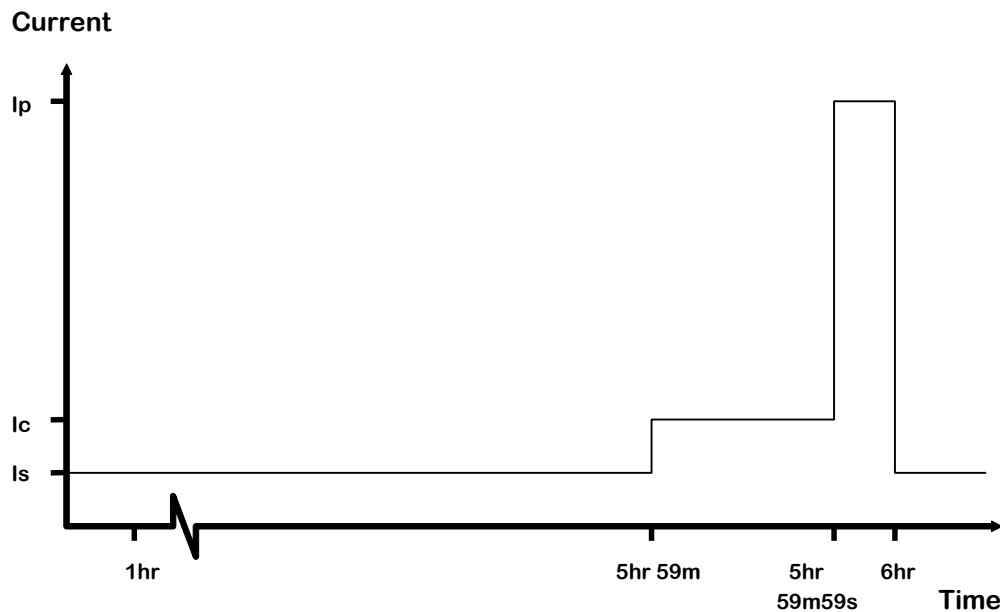
High voltage alarm setting (adjustable)	132V Local+Contact *		
Low voltage alarm setting (adjustable)	117V Local+Contact *		
Charger fail alarm	Local+Contact *		
Battery earth fault alarm	50kΩ Local+Contact *		
Battery high resistance or open circuit	Local+Contact *		
Facility for remote alarm common alarm	Local+Contact *		
Alarm circuit fuse rating	2 A		
Battery Damage (Auto Disconnect / Restore)	Auto Disconnect		
DC Disconnect Function	NPS/003/039		
Battery earth fault alarm test facility			
Operating Method	Push or self-reset switch		
Test Resistor (% below sensitivity of E/F relay)	10%		
Instruments			
Battery output voltmeter	Push or self-reset switch		
Charger output ammeter	Required		
DC output ammeter	Option (0-100mV/A)		
DC Disconnect Function - Relays	NPS/003/039		
DC Disconnect Function – Manual Bypass Switch	NPS/003/039		
DC Disconnect Function – Local/Remote Selector	NPS/003/039		
Cubicles and Battery Stands			
Design life	40 Years		
Cubicle cable entry position	Bottom		
Cubicle Colour	EXTERNAL -light colour, preferably grey, INTERNAL - white		
Exposed Conductors	Shrouded		
Doors I	Lockable		

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	Dimensions	As per site requirements		
	Distribution Board			
	Number of ways	16A or 32A As per site requirements		
	Rating of ways	As per site requirements		
	Distribution Output Isolation			
	Fuse	HD60269-2		
	DC Disconnect Function	NPS/003/039		

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Appendix 4 – Discharge Profiles



BATTERY DISCHARGE PROFILE 6 HOURS

Where:

Determination of Loading

In substation applications there are three separately identifiable segments of loading; standing load (I_s), one minute duty (I_c), and peak duty (I_p).

Standing Load (I_s)

$I(s)$ is the steady load which appears on the battery throughout the assigned standby period of 24 or 6 hours (to be specified at the time of ordering). This comprises relay power supply, indication and any ancillary load fed by the battery.

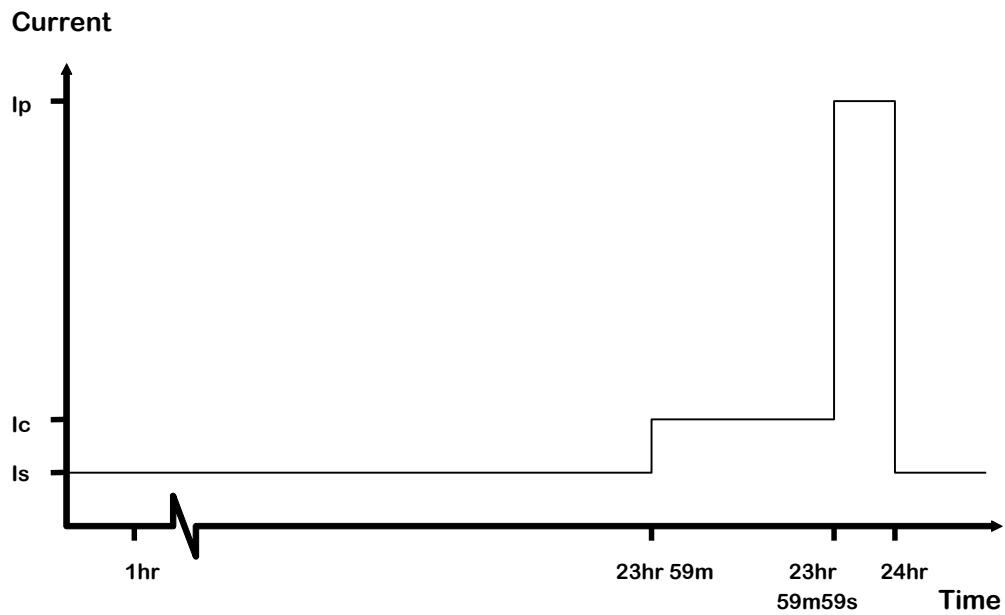
One Minute Duty (I_c)

This load is the current required (at nominal voltage) for sequential and immediately consecutive closing of the circuit breakers on the lower voltage switchboard. It is normally taken as being applied continuously for the last full minute of the standby period.

Peak Duty (I_p)

The peak closing duty occurs at the end of the discharge period, and is the current associated with closing each higher voltage circuit breakers consecutively. This duty reflects a peak current sustained for a very short time. A short duration tripping peak will also arise where bus zone protection is installed.

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BATTERY DISCHARGE PROFILE 24 HOURS

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Appendix 5 - Addendum to Suppliers Requirements

Project specific installation and protection requirements will be provided by Primary Engineering Projects for inclusion in this appendix.

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Appendix 6 - Pre-commission testing, Routine Inspection and Maintenance requirements

Tenderers shall provide details of the recommended pre-commission testing and inspection required.
Details of the Test Voltage Levels, duration, pass/fail criteria, etc. shall be provided.
Tenderers shall state any maximum voltage that may be applied or any other limitations that may apply.

Tenderers shall provide information regarding detailed and periodic inspection and maintenance requirements to be undertaken during the lifetime of their product.

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Appendix 7 – Technical Information Check List

Provided (Y/N)	Requirement
	Full product descriptions and part number/reference
	Complete set of drawings for each variant
	Appendix 2 - completed technical information check list
	Appendix 3 – completed self-certification conformance declaration against applicable BS EN standards, ENA TS 50-18, NPS003016 and NPS/003/039
	Appendix 7 - Recommended periodical inspection and maintenance requirements
	Appendix 8 – This table
	Type test & special test listing and/or evidence
	Routine test plan (example)
	Packaging/transport/delivery/handling/storage information