NPS/003/037 - Technical Specification for 48V DC Telecommunication Battery, Charger and Combined 24V DC Positive Earth and 230V Mains Inverter Systems

1. Purpose

This document is the technical specification for -48volt DC Telecommunication battery and charger systems for use by Northern Powergrid (the Company). Including integrated 230V mains inverter option.

This document supersedes the following documents, all copies of which should be destroyed.

Reference	Version	Date	Title
NPS/003/037	2.0	Feb 2016	Technical Specification for 24 & 48 volt Telecommunication Battery and Charger Systems

2. Scope

This document applies to the requirements for -48 volt DC Telecommunication battery and charger systems for use at the Company's substations to support telecommunications equipment with DC supply requirements of -48 Volt or -24 Volt Positive Earth or 230V AC contrived from those same batteries.

Northern Powergrid own and operate a Private Corporate Network (PCN) which provides a transmission medium for data, PMR, operational telephony, SCADA systems and electricity network protection signalling throughout the licensed areas.

The equipment that forms part of the PCN requires a primarily DC supply that provides a stable DC voltage and power backup for a minimum of 8 hours where the load can be supported by a generator or up to 72 hours when no generator is available, in a loss of mains supply condition. A combined 230V mains inverter may also be required.

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3. Technical Requirements

Battery and charger systems shall be supplied that meet the specified requirements in this document. The technical specification of any system must be declared using the table in Appendix 1.

The equipment shall comply with the current editions of IEC 60623, IEEE 1115-2000, ENATS 50-18, and applicable appendices of this document except where varied by this specification and associated appendices.

3.1. Battery Technology

Northern Powergrid currently predominantly employs use of sealed lead–acid batteries. Newer alternative battery technology to be considered.

3.2. Site Specific Solutions

In order to meet the specific requirements of each site to be installed, a range of power system capacities are required. These will have nominal supply voltages of -48 volts DC with load currents as specified. Load current includes any inversion to supply 230V at not exceeding 5 Amps.

System build drawings (including overall dimensions) are to be supplied for the following examples

-48 volts DC - -48/-24 volts DC (DC–DC converter): - -48 volts DC with 230V AC inverter Output

- Up to 2 Amp Load for 72 hours
- Up to 6 Amp Load for 72 hours
- Up to 10 Amp Load for 72 hours
- Up to 40 Amp Load for 8 hours

3.3. System Size

The DC system will be 19” rack mountable or alternatively, provided in a cabinet with approximate dimensions of 600x600mm and 37-54U height. All cabinets and mounting racks and the auxiliary equipment and wiring (both internal and external) shall be fully compliant with ENATS 50-18. Cable entry should be available through both the bottom and through the top. The cabinet shall have a front and rear doors, both lockable. Side panels should be removable.

3.4. AC Input

The DC system will be supplied by a 230volt AC, +10% / -6% single phase supply up to 63 amps with isolator switch with motor rated fuse or preferably D type circuit breaker not rated less than that provided in the system internally.

The AC input is to be connected to the system via integral surge arrestors that will protect the DC system against over voltage conditions on the AC supply. There will also be integral mains isolation circuit breaker rated appropriately for the system.

Where the surge arrestors are of a sacrificial nature, 2 sets of spare devices shall be included with each system supplied.

3.5. DC Input

Optional consideration to be given to alternative input sources including Solar PV, wind generation or similar as example.

3.6. Output Distribution

The system will have a minimum of 6 built in BS EN 60898-2 compliant MCB outlets per voltage for Telecommunications Equipment to allow for local site distribution. These will be variable in size to accommodate equipment of different loads as specified in the schedule in Appendix 1. The system shall have a positive Earth.

3.7. Control System

The controller for the DC system shall be IP enabled and will include GPRS connectivity where local IP networks are not available. Preferably this will be integral to the system (Northern Powergrid would provide GPRS SIM cards) or be of an external nature provided by Northern Powergrid.

The controller shall collect and distribute system information and alarms to specified destinations via the IP connection. Where this distribution is to use Simple Network Management Protocol (SNMP), then Management Information Databases (MIBs) for SNMP V3 are to be supplied.

The controller shall allow local and remote management of the system. The management connection will allow interrogation for fault investigation. This will include historic alarm information, historic system tests and current system information.

The controller shall also include a minimum of 2 'dry' relay inputs and 2 'dry' relay outputs.

The controller shall perform automatic load testing by programmable schedules and on completion of the load test, push the result to a specified destination.

The controller shall perform battery symmetry monitoring. The system shall support a minimum of mid-point symmetry for each battery string capable of being installed in the system (Maximum 4 strings).

The controller shall be able to monitor system temperatures and if available supports alarm indication, remote control and configuration of remote systems.

3.8. Rectifiers

The system shall have removable rectifier units that can be exchanged with the system fully operational. N+ 1 rectifier's are to be specified with each system.

The maximum potential current load of the rectifier shall be set by the control system.

3.9. Alarms

The system shall be able to display current status and alarms locally. Suppliers shall list the alarms that the system can produce. This must include BATTERY over temperature monitoring and alarm output

Any threshold values shall be able to be changed if required.

All Alarms (including alarm text) shall be configurable with respect to the severity and thresholds. External alarm input text shall be configurable. The distribution of alarms via the IP connection and / or relay outputs shall be configurable as required. The DC system shall exclude 'mains fail' if it is system generated under self-test conditions.

3.10. Temperature Management

Any system must include a means of assessing and monitoring and recording battery temperatures long term. This must be stable and reliable and monitor accurately battery temperatures (not cabinet or within [say] a control unit).

Reasons for the temperature monitoring / management are related to battery life and performance AND, in conjunction with the alarm output detailed in 3.9 for fire risk mitigation.

4. References

The products described within this specification shall comply with the latest versions of the relevant International Standards, British Standard Specifications and all relevant Energy Network Association Technical Specifications (ENATS) current at the time of supply.

4.1. External Documentation

Reference	Title
BS EN 60622	Secondary cells and batteries containing alkaline or other non-acid electrolytes – sealed 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 60898-2	Circuit-breakers for overcurrent protection for household and similar installations. Circuit-breakers for a.c. and d.c. operation
ENATS 50-18	Design and application of ancillary equipment
IEC 60623	Vented nickel cadmium prismatic rechargeable single cells
IEEE 1115-2000	Recommended practice for sizing nickel cadmium batteries for stationary applications

4.2. Internal Documentation

Reference	Title
None	

4.3. Amendments from Previous Version

Reference	Amendments
2.0	Inclusion of combined 230V mains inverter
3.1	Alternative battery technologies invited
3.2	Inclusion of combined 230V mains inverter; minor change to load requirements
3.4	Inclusion of isolator switch and circuit breaker
3.5	New clause to allow local generation DC input
3.10	New clause requiring temperature monitoring/management

5. Definitions

Term	Definition
GPRS	General Packet Radio Service
IP	Internet Protocol
MCB	Miniature Circuit Breakers
MIB	Management Information Database
PCN	Private Corporate Network
PMR	Private Mobile radio
SCADA	Supervisory Control and Data Acquisition
SNMP	Simple Network Management Protocol
The Company	Northern Powergrid

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	04/04/2022

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
Dave Tedstill	Telecoms Project Engineer	05/04/2022
Tony Lamb	Telecoms Operation Engineer	07/04/2022

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
Andy Roberts	Operational Lead Engineer	05/04/2022
Pete Buckley	IS Operations Manager (Telecoms)	07/04/2022
Joe Helm	Policy & Standards Manager	04/04/2022

6.4. Authorisation

Authorisation is granted for publication of this document.

		Date
Paul Black	System Engineering Manager	07/04/2022

Appendix 1 – Technical Specification for Telecommunication - 48V DC battery and battery-charger system Positive Earth

Battery Output Voltages and Load Duty	
Nominal voltage	-48V
Float voltage	As determined by battery data sheets
Minimum open circuit voltage (OCV) after specified discharge profile	As determined by battery data sheets
Maximum voltage under all conditions	-60V
Battery standing load	See Clause 3.2
Battery discharge profile	See Clause 3.2
Other Battery Design Factors	
Standard	
Type	Sealed Lead Acid or appropriate alternative
Minimum Service life	15 years
Battery Capacity	See Clause 3.2
Ageing factor	As determined by battery data sheets
Rated temperature	15°C
Temperature range	-5°C,+ 40°C
Mounting	19" rack mountable or alternatively, be provided in a cabinet with approximate dimensions of 600x600mm and 37-54U height
Connectors	Shrouded
Isolation facilities required	From charger and distribution board
Battery earthing	**The positive battery terminal shall be earthed to provide -48V DC.**
Low Voltage Disconnect	A load disconnect feature is required to prevent battery damage.
Charger Supply	
AC Supply	230v AC single phase
Supply Isolation	Double Pole Switch and Fuse or MCB
Supply Range	+10% / -6%
Surge Arrestor	All mains inputs protected
Bypass arrangement	See Clause 3.4
Nominal supply frequency	50Hz
Supply frequency range	47 / 52 Hz
Charger	
Type	Constant voltage, single stage, temperature compensated.
Ambient temperature range	-5°C, + 40°C
Float Voltage	As determined by battery data sheets
Maximum voltage under all conditions	-60V
Rated charging current	To cover standing load as specified plus adequate charging current
Charger voltage ripple / transient output	≤2mV (RMS) CCITT weighted No voltage transient shall occur on restoration of charger mains supply.

Battery/Charger Output Variation for :- Input voltage of 230V +6% / -10% Frequency of 50Hz +/- 10% Output load between 0 – 100%	Float Voltage +/- 0% (@ output terminals)
System Monitoring	
Supply healthy / fail alarm	See Clause 3.9
Charger healthy / fail alarm	See Clause 3.9
Battery low voltage disconnect	See Clause 3.9
Control System	See Clause 3.7
Management System	See Clause 3.7
Cubicles and Battery Stands	
General arrangement	19” rack mountable or alternatively, be provided in a cabinet with approximate dimensions of 600x600mm and 37-54U height
Design life	10 years
Cubicle cable entry	Bottom and top.
Cubicle Colour	Light grey
Exposed conductors	Shrouded
Doors	Lockable both front and rear
Side panels	Removable
Distribution Board	
Number of ways	Min 6 (six) BS EN 60898-2 compliant MCB outlets
Rating of ways	Mix of 2A, 6A, 16A
Training	
Courses available	
Installation	
Services Available	

Appendix 2 – SELF CERTIFICATION CONFORMANCE DECLARATION

-48V Battery and positive earth 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.

Conformation 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

Notes

Appendix 2 continued

TECHNICAL SPECIFICATION FOR TELECOMMUNICATION -48V DC BATTERY AND BATTERY CHARGER SYSTEMS			
	Clause / Requirements	**Conformance Code**	**Remarks / Comments**
System Output Characteristics			
Nominal voltage	-48V		
Float voltage (max acceptable)	State		
Minimum open circuit voltage (OCV) after specified discharge profile	State		
Maximum charger voltage under all conditions	-60V		
Maximum open circuit voltage	State		
Battery			
Standard	State (BS / BS EN / IEC?)		
Type of cells	state		
Service life	State		
Aging factor applied	State		
Number of cells in battery	State		
Float voltage per cell	State (V)		
Rated temperature	15 ^{o}C		
Temperature range	-5 / +40 ^{o}C		
Connectors	Shrouded		
Isolatable from both distribution board and charger	Required		
Battery Earthing	Positive Earthed		
Remote Voltage Monitoring Facility	Required		
Auto Battery Disconnect	State		
Charger Supply			
AC Supply	230V / 1 Phase		
Supply Isolation	DP Switch and Fuse or MCB		
Surge Arrestor type	Required		
Bypass Arrangement	State		
Nominal supply frequency	50Hz		
Supply frequency range	47-52Hz		

Appendix 2 continued

	Clause / Requirements	Conformance Code	Remarks / Comments
Charger			
Type	Constant Voltage		
Ambient temperature range	-5 / +40 °C		
Float Voltage	State		
Maximum Voltage	-60V		
Voltage adjustment facility (float - located behind facia).	Required		
Battery/Charger Output Variation for :- Input voltage of 230v +6% / -10% Frequency of 50Hz +/- 10% Output load between 0 – 100%	Float Voltage +/- 0% (@ output terminals)		
System Monitoring			
Alarms	State		
Control System	State		
Management system	State		
Cubicles and Battery Stands			
Design life	State		
Mounting Arrangement	State		
Cubicle cable entry position	Bottom / Top		
Cubicle Colour	Light Grey		
Exposed Conductors	Shrouded		
Doors l	Lockable		
Dimensions (state H x W x D in mm)			
Distribution Board			
Number of ways Minimum BS EN 60898-2 compliant MCB outlets	state		
Rating of ways	State		
Training			
Course Details	State		
Installation			
Services available	State		

Appendix 3 – Schedule of Requirements

Item	Volts	Load		
			Product Ref	Price
1	48V	Up to 2 Amp Load for 72 hours - system		
2		Up to 6 Amp Load for 72 hrs - system		
3		Up to 10 Amp Load for 72 hrs - system		
4		Up to 40 Amp Load for 8 hrs - system		
5	48V & 24V	Up to 2 Amp Load for 72 hrs - system		
6		Up to 6 Amp Load for 72 hrs - system		
7		Up to 10 Amp Load for 72 hrs - system		
8		Up to 40 Amp Load for 8 hrs - system		
9		48V Rectifier – spare		
10		24V Rectifier – spare if required		
11		48V – 24V DC-DC Converter - spare		
12	48 V	Controller – spare		
13	48 V	230 V inverter - spare		
14	-	Surge Arrestor – spare		
15	12 V	Type appropriate to system low capacity e.g. 100Ah		
16	12 V	Type appropriate to system med capacity e.g. 155Ah		
17	12 V	Type appropriate to system high capacity e.g. 190Ah		
19		Circuit breaker – spare or additional		
20	-	Training		
21	-	Installation		
22	-	Delivery		

Notes:-

Matrix to be completed by tenderers

Please indicate any volume discounts for the order quantities of 5, 10, 20 or 50 systems (any load and including batteries)

For Delivery please use volumes above and deliveries to Hull and Billingham

Appendix 4 - Pre-commissioning Testing, Routine Inspection and Maintenance Requirements

- Tenderers shall provide details of the recommended pre-commission testing and inspection required for the batteries or chargers.
- Tenderers shall provide information regarding periodic inspection and maintenance requirements to be undertaken during the lifetime of their product.
- Detailed inspection and maintenance instructions shall be also be provided

Appendix 5 - Technical Information Check List

The following information shall be provided by the supplier for review by Northern Powergrid. Additional information shall be provided if requested.

Requirement	Provided (Y/N)
Full product descriptions and part number/reference	
Appendix 2 – completed self-certification conformance declaration(s)	
Appendix 3 – Completed Schedule of requirements	
Appendix 4 – Completed pre-commission testing and inspection recommendations for the installations	
Complete set of drawings for each item	
Type test evidence	
Packaging information	
Instructions/Manuals for transportation & handling, installation, maintenance and disposal	
Spares availability list	