1. SCOPE

This Specification details the Company's requirements for 30V, 30/48V, 48V and 110V standby auxiliary D.C. supplies. The auxiliary D.C. supplies will be used for operation of switch tripping, protection tripping and other ancillary apparatus within primary or secondary substations.

2. ISSUE RECORD

This is a Reference document. The current version is held on the EN Document Library.

It is your responsibility to ensure you work to the current version.

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June 2009	6	D Neilson	6th Issue, Update to Drawings
Sept 2010	7	P Dolan	7th Issue, Major Amendments to Document. Addition of load disconnection functionality for in line with Black Start Resilience Strategy
March 2014	8	P Dolan	8th Issue, Updates to System Types and Requirements
Dec 2016	9	P Dolan	9th Issue, Updates to Battery Fusing Arrangements, DC Inputs and addition of separate distribution board requirements
Dec 2020	10	P Dolan	10th Issue, General updates

3. ISSUE AUTHORITY

Author	Owner	Issue Authority
Patrick Dolan Lead Engineer	Fraser Shaw Substations Manager	Fraser Ainslie Head of Engineering Design and Standards F Ainslie Digitally signed by Fraser Ainslie DN: cn=Fraser Ainslie, o=Process and Technology, ou=Engineering Design and Standards, email=fraser.ainslie@spenergynetworks.co.uk, c=GB Date: 2021.02.17 13:53:15 Z

4. REVIEW

This is a Reference document which has a 5 year retention period after which a reminder will be issued to review and extend retention or archive.

5. DISTRIBUTION

This document is not part of a Manual maintained by Document Control and does not have a maintained distribution list.

6. CONTENTS

7. DEFINITIONS AND STANDARDS

7.1 Definitions

For the purpose of this specification, the following definitions shall apply:

Approved:	Equipment which is approved in accordance with SP Energy Networks documents for use or installation on the Company network.
Company:	Refers to SP Distribution plc, SP Transmission plc and SP Manweb plc.
Energisation:	The application of Voltage to an item(s) of Equipment from the system.
Engineer:	The Company's representative having authority over technical matters contained in this Specification.
New:	Approved Equipment which has not previously been connected to the system and which has been routine tested in a Manufacturing Facility with a Quality Management System in accordance with the relevant standard prior to delivery.
SPEN:	SP Energy Networks, the brand name for the division of the ScottishPower group of Companies that encompasses SP Distribution plc, SP Manweb plc, SP Transmission plc, SP Power Systems Ltd and ScottishPower Energy Networks Holdings Ltd.
SP Distribution plc:	The Distribution Licence Holder for the distribution service area formerly known as ScottishPower.
SP Transmission plc:	The Transmission Licence Holder for the transmission service area formerly known as ScottishPower.
SP Manweb plc:	The Distribution Licence Holder for the distribution service area formerly known as Manweb.
Tenderer:	The supplier invited to tender in accordance with this Specification.

7.2 International and British Standards

Equipment must preferably comply with all specified requirements, including those in the British Standards or other primary standards listed in this Specification, and all ENA Technical Specifications to which this standard refers. Where equipment is designed to an associated or equivalent standard, the Tenderer shall state in the tender all variations from the listed primary standard in equipment design/performance and shall state the title of any Associated or equivalent standard.

7.3 Equipment Components to be offered for Approval

Where components are specified in general terms, and specific types stated to be Approved items, equivalents may be offered for Approval. However, this must be made clear in the tender documents and sufficient information on the design and engineering performance of the equivalent components must be provided to enable a complete appraisal to be made.

Unless otherwise specified or approved, all materials and equipment used in the contract works shall be in accordance with the latest revisions, at the time of tender of such Company Technical Specification, Electricity Networks Association Technical Specification, British Standards, ISO and IEC Standards as are applicable, and in that order of preference.

8. REFERENCES

The following standards and other documents are referred to in this Specification:

8.1 Statutory Legislation

Health and Safety at Work Act 1974
Electricity at Work Regulations 1989
Provision and Use of Work Equipment Regulations 1992

8.2 International Standards

IEC 60297	Dimensions of mechanical structures of the 482.6mm (19in) series
IEC 61000	Electromagnetic compatibility (EMC)
IEC 60068	Environmental Testing
IEC 62271-1	Marking and labelling of enclosures
IEC 60269-1	Low Voltage Fuses
ETS 300 132-2	Environment Engineering (EE); Power supply interface at the input to telecommunications equipment; Part 2: Operated by direct current (dc)

8.3 British Standards (BS)

BS 88	D.C. Cartridge fuses for voltages up to and including 1 000V A.C. and 1 500V
BS 923	Guide on high voltage testing techniques
BS 5499	Safety Warning Labels
BS 6121	Mechanical cable glands
BS 6132	Safe operation of alkaline secondary cells and batteries
BS 6133	Safe operation of lead-acid stationary batteries
BS 6231	Specification for PVC-insulated cables for switchgear and control wiring
BS 6290 - Part 4	Specification lead acid valve regulated sealed type batteries
BS 7671	IEE Wiring Regulations Seventeenth Edition
BS EN 61558	Safety of power transformers, power supplies reactors and similar products
BS EN 60898	Circuit–breakers for over current protection
BS EN 608696-21	Stationary lead-acid batteries: Value regulated types – Methods of test
BS EN 608696-22	Stationary lead-acid batteries: Value regulated types – Requirements

8.4 ENA Technical Specifications (TS) and Engineering Recommendations (ER)

ENA TS 09-6	Auxiliary multi-core and multi pair cables
ENA TS 50-18	Design and application of ancillary electrical equipment
ENA TS 98-1	Surface preparation and paint finish of new plant and equipment
ENA TS 50-19	Standard numbering for small wiring
ENA TS 48-5	Environmental Testing for Protection Applications
ER G5/ 4	Limits for harmonics in the UK electricity supply system

8.5 SPEN Documents

BATT-03-003	Substations D.C. Load Management Controller Requirements
	SPEN Approved Equipment Register - Batteries

8.6 Drawings

The schematic drawings for requested Battery Systems are shown in Section 10, BATTERY SYSTEMS INDIVIDUAL REQUIREMENT SCHEDULES.

9. REQUIREMENTS

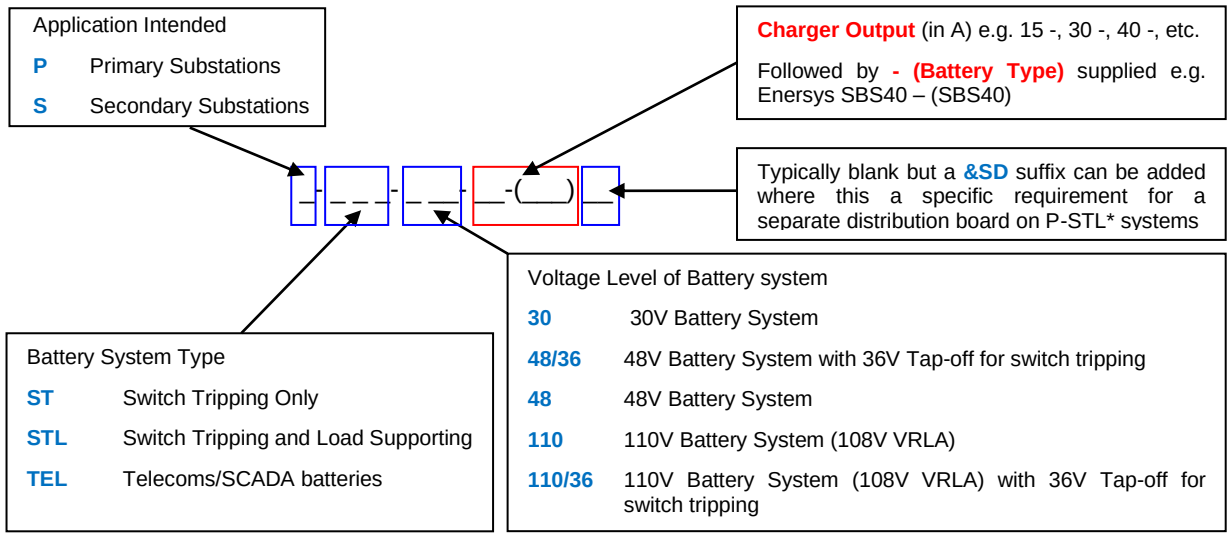
9.1 General Requirements

There is a requirement for three types of battery systems in this specification, mainly:

- Systems with requirement to perform switch tripping with no standing load
- Systems with requirement to perform switch tripping and support standing load
- Systems with requirement to support standing load no switch tripping requirement

Monitoring is not required on battery systems with no standing load requirement. All battery systems with requirement to support standing load shall be monitored (see section 9.7).

The naming convention for battery types shall be as follows:



The tender will provide one solution for each of the battery systems defined in the table below. Aside from the battery systems defined in the table, bespoke battery systems may be required for specific substation applications. All battery systems of the types outlined above must meet all of the relevant requirements outlined in this document.

Parts of the naming convention marked in Blue are set identifiers for the generic system type. Part of the naming convention marked in Red will be specific to prospective supplier's offerings for the generic system types.

Type	Description	Min Charger Output	Charger Shall accommodate batteries with capacities up to
S-ST-30-Y(Cylon X)	Wall Mounted Unmonitored 30V Switch Tripping Only Battery System	0.5A	5AHr
S-ST-48-Y(Cylon X)	Wall Mounted Unmonitored 48V Switch Tripping Only Battery System	0.5A	5AHr
S-STL-48-Y(X)	Monitored 48V Switch Tripping and Load Supporting Battery System	5A	40AHr
S-STL-110-Y(X)	Monitored 110V Switch Tripping and Load Supporting Battery System	8A	60AHr
P-STL-30-Y(X)	Monitored 30V Switch Tripping and Load Supporting Battery System	15A	130Ahr
P-STL-48-Y(X) **P-STL-48/36**-Y(X)	Monitored 48V Switch Tripping and Load Supporting Battery System with option of 36V tapping fully rated for switch tripping.	15A	125Ahr
		25A	190Ahr
P- STL-110-Y(X) **P- STL-110**-Y(X)**&SD** **P- STL-110/36**-Y(X) **P- STL-110/36**-Y(X)**&SD**	Monitored 110V Switch Tripping and Load Supporting Battery System.	15A	125Ahr
		25A	190Ahr
		30A	250Ahr
P- TEL-48-Y(X)	Monitored 48V Telecoms and SCADA Load Supporting Positively Earthed Battery System.	5A	40Ahr
		13A	100Ahr
		25A	180Ahr
SD	Separate DC distribution Board which couples with P-STL systems	N/A	N/A
E-Cab	Extension cabinet and shelving to set up to two sets of 110 (108)V batteries (with facility to couple with existing installation	N/A	125Ahr

9.2 Equipment Standards

The Company welcomes innovation and alternatives to traditional designs that still meet the functional requirements of this Specification.

Variations must be clearly identified and prices for compliant and non-compliant equipment separately detailed.

9.3 Equipment Description

The design of equipment shall meet the requirements of the Health and Safety at Work Act 1974, the Electricity at Work Regulations 1989 and the Provision and Use of Work Equipment Regulations 1992, for the maximum safety of all personnel.

A brief description of the charger control design principles shall be included with the tender, such that the method of operation and the component types used are made clear.

9.4 Departures from Specification

The Tenderer shall state in Technical Schedule B4 all departures from the requirements of this Specification.

9.5 Charger Requirements

Inputs and Outputs to the charger shall be easily accessible for testing purposes.

The Tenderer will be required to complete the Technical Schedule B2.

9.5.1 Input

The charger will be operated from a 230V A.C. 50 Hz single-phase supply. The variations of supply will be between +10/-10% of the voltage and +/-1% of the frequency.

Isolation between input and output shall be provided by a double wound transformer having its windings separated by an earth screen in accordance with BS EN 61558, and further detailed in BS 7671: IEE Wiring Regulations: Protective measure: extra low voltage 414.3 & 414.4.

All elements of the design shall be able to withstand an overvoltage 433V A.C. R.M.S. differential across all terminals (connected to mains input) for up to 1 sec without any damaged to components or permanent loss of function.

9.5.2 Charger Output

All battery chargers shall include temperature compensated charging capability.

The voltage output setting range of the charger shall be quoted in the tender so that all compatible batteries can be identified by the Company. Charger output settings shall be adjusted in line with the battery manufacturer's guidelines for all batteries supplied with the associated chargers.

Where batteries are not supplied with the charger and the batteries that will be coupled with the charger are not defined at the time of order, a default setting of 2.30V charge per cell at 20°C shall be applied, and temperature compensated charging shall be enabled. Otherwise the charger output and temperature compensated range shall be matched the defined battery by the charger supplier.

Output from the charger shall be constant D.C. with a ripple content that shall not exceed +/-3%, without the battery connected.

The value of any internal discharge on loss of A.C. supply via the charger with no load connected shall be stated in the tender. Internal discharge shall not exceed 0.25mA for all battery systems not designed to support standing load (ST Systems). Internal discharge shall not exceed 25mA for (STL) load supporting battery systems and telecoms (TEL) battery systems.

9.5.3 Environment

The charger shall not produce interference on the A.C. input more than that specified in EA Engineering Recommendation G5/4.

The equipment offered shall be tolerant of temperatures (-10C – +55C) and humidity levels 5% – 93%). Reference should be made to the IEC 60068-2.

Systems will be installed in some environments where dust is present, therefore systems which are not reliant on forced air-cooling will be considered favourably in the enquiry.

9.5.4 Charger Asset Life Expectancy

Chargers offered for Tripping applications shall have evidence to support a minimum expectancy life of 25 years and Chargers offered for "TEL" supporting applications shall have evidence to support a minimum expectancy life of 20 years within the environments quoted. Switch Mode Rectifiers shall not be offered for ST or STL systems. For TEL systems, Switch Mode Rectifiers shall be only considered if applied as part of a dual rectifier system.

9.5.5 Terminals and Connectors

All terminations shall be to ENA TS 50-18. The main connections between the charger unit, battery and D.C. distribution board shall be provided by PVC or XLPE insulated cable of adequate mechanical strength and current carrying capacity and terminating in two ring type terminations on the battery.

Terminals & connectors shall be protected against inadvertent contact by an operator. Battery terminal shrouding shall allow access for maintenance and measurement.

The P-STL-110/36 and P-STL-48/36 battery systems shall have a reduced tapping point at 36V that shall be fully rated.

9.5.6 Small Wiring

Small wiring shall be suitably rated stranded conductor, Type B, in accordance with BS 6231. Wires shall be coloured in accordance with the following code: ENA TS 50-18 'small wiring shall be coloured white, except for earth cables, which shall be Green/Yellow. End marking shall be in accordance with clause 4.8.

All wires at the equipment interface point shall have numbered ferrules at both ends in accordance with ENA TS 50-19.

9.5.7 Equipment Identification

For material control and inspection purposes, equipment markings, nameplates and supplier's information shall be in accordance with international standards.

All the information shall be marked in an indelible manner on the equipment itself or on a rating plate.
The Charger equipment shall carry at least the following marking:

- Manufacturer and model
- SP Type Identifications (ST, STL or TEL)
- Serial number
- Year/month of manufacture
- DC Voltages and current output ratings

In addition, a Quick Response (QR) Code tag in VCard Format shall be provided, either on the rating plate or as a separate plate, including the most relevant data to identify the specific unit. This shall include, as a minimum, manufacturer and model, date of manufacture, serial number, SP Type identification, DC voltage, Current Output rating. In addition, it should include electronics modules firmware edition(s), equipment drawing and manual references information. This QR code shall be readable during the lifetime of the asset. For this reason, laser engraving will be preferred, although other methods can be considered for agreement with the Engineer.

9.6 Battery

The tenderer shall offer the option to supply Chargers with and without batteries. The type of battery offered with the chargers will be at the choice of the Tenderer subject to SPEN approval.
The required life expectancy of the battery shall be 10 years or greater at environmental conditions (-10°C – +25°C) and shall have a Eurobatt classification of 12 Year+ design life. A statement to that effect shall be included in the tender. Where nominal 110V VRLA Battery sets are requested, 108V made up of 54 Cells (9X12V Blocks) are required.

The Battery System (Charger, Fittings, Wiring, D.C. distribution board) shall be capable of withstanding the D.C. short circuit current of any batteries (sets) offered as per BS EN 608696-22:2004, Clause 6.3.

VRLA batteries submitted in the Tenderer's proposal shall be tested in accordance with BS EN 608696-21:2004 and meet all requirements identified in BS EN 60896-22:2004. Test data for all tests performed on the VRLA batteries proposed shall be made available upon request. The tender will need to complete Schedule B1 for any batteries offered for consideration for all products not currently approved (for the application identified), this requests information relating to a number of the tests specified in BS EN 60896-22.

Further information required from the Tenderer regarding battery selection shall be completed in Technical Schedule B1 - Battery.

All batteries shall be clearly marked to identify the manufacturer, the type reference and the date of manufacture, which shall not be a code. This marking shall be clearly visible from the front of the unit without dismantling the batteries. The +ve and -ve, and all reduced voltage terminals shall be clearly labelled.

All batteries shall be supplied in a fully charged condition and within 3 months from date of manufacture.

Approval in writing shall be obtained from the Engineer for batteries offered in this contract; any deviations for new solutions should be referenced against SPEN Approved Equipment Register - Batteries.

9.7 Charger Controls, Indications and Alarms

The charger fittings required will be specific to the individual battery systems as detailed in the individual system schedules outlined in section 10.

Voltmeters and Ammeters may be by means of analogue instruments or via LCD displays. The Voltage Across each battery set shall be monitored and displayed locally and transmitted remotely.

All Battery Systems shall have Test switches of the self re-set type controlling a battery test load.

Where specified D.C. charger input fuse holders shall be fitted with appropriately rated HRC fuses, to allow the D.C. supply to be maintained from an alternative source while maintenance/ replacement of the main battery cells is undertaken.

Where specified, battery monitoring shall have the following features:

- Periodic battery asymmetry monitoring and alarm;
- Periodic battery impedance monitoring and alarm;
- Configurable High and Low voltage detection and alarm:
    - These must be set to manufacturer's recommendation for specific cells used where cells are supplied with the charger
    - Where chargers are supplied without cells the following default settings must be applied:
        - Low Alarm – 2.1V / cell (Default)
        - Low Alarm Reset – 2.25V / cell, 30 sec alarms reset required
        - High Alarm – 2.4V / cell (Default), 2.5 Seconds reset required
        - High Voltage Charger shutdown and alarm– 2.53V/Cell (Default)
            - High Volts shutdown shall be manual reset (and reconnection via a push button switch).
- An earth fault alarm shall be configured for STL battery systems; this is not required for positive earthed TEL battery systems:
    - This shall detect Earth faults on either pole of the associated D.C. system
- Supply fail and charger failure alarm;
- Fuse Fail Alarms (TEL Systems Only).

9.7.1 Auto Test Facility

The facility to automatically test the battery sets by switching charger output down and supply the standing load (only) shall be provided with all STL and TEL D.C. systems. The regularity and duration of the test should be adjustable and be executed in a manner where there is no risk to the continuity of supply to the load and such that there is no appreciable degradation of the battery asset life.

9.7.2 Battery Deep Discharge Protection

Options should be offered for solutions to prevent deep discharge on TEL battery systems and STL systems intended for use in secondary substations. Details of all solutions offered, and costs should be included in the enquiry. Where offered, associated systems shall have the facility to enable or disable deep discharge protection as required.

9.7.3 High Voltage Charger shutdown

The high voltage and charger shutdown facility should, alarm and cut-off respectively when the charger output goes beyond a pre-set threshold (default 2.53V/Cell). Reconnection of the charger supplies should be manually initiated by a dedicated push button.

9.7.4 Test Discharge Function

All systems shall include a dedicated Push Button; Self Reset Type which when pressed imposes a battery test load in addition to all connected D.C. loads. Safeguards must be provided to ensure that the load is not applied for a period exceeding 10 seconds. When connected, the test load shall draw a current equal or greater than the charger output capability / C10 Current Rate of associated battery unless otherwise agreed.

This switch shall either disconnect the charger or lower the charger output when pressed and shall either initiate an alarm if battery problem is detected or give a visual indication of battery output voltage for the duration of the test (for unmonitored systems).

The test load resistor shall be located within the battery and charger system and shall be placed in manner as to reduce risk of fire and risk of personal contact.

9.7.5 Local Indications and Remote Alarms

When battery monitoring is specified & fitted, the following Local Indications and Remote Alarms shall be raised for the following conditions:

Condition	Local Indication			Remote Alarm	
	Presentation	Time Delay	Potential Display Grouping	Time Delay	SCADA Alarm Grouping
Mains Fail Loss of A.C. Supplies to the Charger unit	LED / LCD	Instantaneous	Mains / Charger Fail	10 minutes	Urgent
Charger / Rectifier Fail (“)	LED / LCD	Instantaneous		10 minutes	
High Volts Alarm	LED / LCD	Instantaneous		1 minute	
High Volts Shutdown	LED / LCD	Instantaneous		1 minute	
Low Volts alarm	LED / LCD	Instantaneous		1 minute	
Asymmetry alarm	LED / LCD	Instantaneous	Battery Fail	1 minute	
Auto-test facility (Battery Fail detection)	LED / LCD	Instantaneous		1 minute	

High Impedance (option)	LED / LCD	Instantaneous		1 minute	
Deep Discharge Protection Operations (if provided)	LCD	Instantaneous		1 minute	
Fuse Fail Alarm (^)	LCD	Instantaneous	Fuse fail	1 minute	
Earth Fault (*) Positive Side of the D.C. distribution	LED / LCD	Instantaneous	Earth Fault	1 minute	Non-Urgent
on Negative Side of the D.C. distribution	LED / LCD	Instantaneous		1 minute	

(“) For Dual Rectifier Solutions Urgent Alarm for failure of either rectifier
(^) Required for TEL Systems only
(*) Not required for TEL Systems

Indications of operation of each of the individual alarms provided shall be clearly visible from the charger unit front panel. All fault conditions must initiate a clearly viable Alarm LED or equivalent, however it is acceptable to distinguish individual conditions via LCD display menu (not individual LED indications).

For Fuse Fail Indications, individual Fuse Fail Indications are required for B & C type systems and preferred for A type systems.

Remote alarms shall only be raised after a specified time delay and shall be cancelled in the condition which has initiated the condition is not sustained to stop nuisance alarms caused by transients.

When battery monitoring is specified & fitted, alarm contacts should be of the normally closed in the de-energised state and shall be held open under normal conditions. Any failure in the relays from which the alarms are derived shall result in the issue of the associated alarm(s).

All alarms should be non-latching (or “self-resetting”) in nature and shall be presented as volt-free contacts (wetting current 5-20mA).

In addition to generic requirements alarm output requirements, TEL (B & C) Type Systems shall be remote managed by IP using HPOV or similar, this functionality is preferred for TEL (A) Type Systems but not essential. The supplier shall ensure that all MIBS used are pre-determined and agreed with the Engineer. A RJ45 connection shall be made available for the remote management.

9.7.6 Voltage Monitoring

The Voltage Across each battery set shall be monitored and transmitted remotely for selected Primary Substation STL Systems confirmed in schedules, Section 10 BATTERY SYSTEMS INDIVIDUAL REQUIREMENT SCHEDULES. The minimum of accuracy of all measured analogue values shall be +/- 1%.

Outputs should be presented in either of the following formats as required:

- 0 – 10mA
- 4 – 20mA

If offered, options for serial communications will be considered on an individual application basis.

9.8 Enclosure and Distribution Board Requirements

9.8.1 Enclosure Requirements

All Cabinets shall have a minimum rating of IP31, BS EN 60529. All cabinets provided shall be of sheet steel construction throughout. Cabinets shall be front entry.

Where a cubicle has been specified to house a full D.C. system associated sub-elements of the system should be grouped together within the same panel. Charger components, distribution ways and batteries should be segregated and clearly labelled on both the front and rear of the cubicle.

Provision should be made to accommodate a future load disconnection device within the charger cabinet (a minimum rack space of 4u height) for all systems where this requirement is identified, Section 10.

Considerations shall be given to the future maintenance and repair of all battery system components contained within cubicles at the time of the design.

All Cabinets which house batteries shall have adequate ventilation at the highest point in order to prevent the potential build-up of gases should overcharging occur. Cabinet ventilation shall be designed to safely handle gas emissions as would be expected for batteries declared as compatible with the system as per clause 6.1, BS EN 608696-21:2004 (or otherwise applicable standards where an alternative technology to Lead Acid Batteries is offered).

Arrangement of the cabinets for housing batteries should take into consideration the codes of practice set out in BS 6133 for lead acid. Each cabinet shall be acid resistant.

All cabinets housing batteries shall be arranged such that all cells/battery blocks can be visually inspected in situ. Where applicable, the cabinets shall be adequately sized to allow topping up of cells in situ and arranged so that cell levels can be viewed with all cells in position. Battery inspection, maintenance and cell replacement should be able to be carried out by accessing the batteries through doors of the cabinet which do not require tools for access.

The charger components and alarm relay should be sufficiently accessible for test purposes, and for replacement, without compromising the safety of the personnel.

All cabinets shall be fitted with removable M12 high tensile brass earth studs at the bottom of both sides of the cabinet for connecting the substation earth bar to the cabinet for earthing all metalwork. Lifting eyes shall be provided on all free-standing cabinets. Wall mounted Cabinets which weight more than 50kg shall also be provided with lifting eyes.

Cabinets shall be adequately packed to avoid damage in transit. Where reasonably practical a robust pocket, suitable for accommodating the “Commissioning, Operation and Maintenance Manual” and the Battery Logbook, shall be provided on the inside of the cubicle.

In addition to the generic cabinet requirements, individual battery systems have the specific requirements detailed in the individual battery system requirements schedules section 10.

A drawing of the cabinet(s) layout shall be provided at the time of tender. The available space for the accommodation of the battery shall be clearly stated in the tender. The Engineer shall agree cabinet(s) design and layout before the award of the contract.

9.8.2 Cable Entry

Cable entry requirements will be specific to individual systems / distribution boards and as such are defined in battery systems requirements schedules, section 10. Where Cable Glands are provided they shall be to BS 6121. There should be adequate internal access to the cabinet to enable wiring to internal terminals from each respective cable entry point.

There shall be no requirement to modify or dismantle any internal panels to terminate cables of continuous current carrying capacity equal to or greater than the fuses designated for associated D.C. ways. Sufficient space shall be available in the enclosure such that associated cables are able to be terminated without exceeding the manufacturers recommended bend radii and without impinging on any surface or apparatus within the enclosure.

9.8.3 Labelling of Fittings

All enclosures shall be marked in accordance with Clause 5-10 of IEC 62271-1 as referred to in ENA TS 50-18.

A label showing black letters on a white background shall be affixed adjacent to each fitting and terminal, to indicate the function. In the case of a relay, if there is a visible internal label, no additional label is required.

Each Cabinet shall be identified by a non-corroding indelibly marked data plate giving the following information and marked in accordance with ENA TS 50-18.

- Manufacturer's Name
- Year of Manufacture
- Serial Number
- Diagram of Connections, Drawing Number
- The Company's Order Number

Safety-warning labels shall comply with BS 5499 referenced in ENA TS 50-18.

9.8.4 A.C. Supply

Each charger's input supply shall be fitted with appropriately rated 2 pole MCB which comply with ENA TS 50-18 and BS EN 60898-1 and accommodate the maximum inrush of the transformer associated with the charger system.

9.8.5 D.C. Busbars and Distribution

The Fusing/Linking and D.C. distribution arrangements of the battery and battery system controller / instrumentation and distribution ways shall be adequate for the systems where they are provided including safely requirements listed in BS EN 50272-1 and BS EN 50272-2.

It shall be possible to fully isolate the charger unit from the D.C. Busbars and Battery. Each ring and spare way shall be supplied with suitable labelling of output fuse holders.

Suggested distribution configurations are listed in the charger schedules, Section 10 which includes options for batteries and chargers with integrated distribution boards and external distribution boards. Variations from these nominal distribution arrangements will be requested as required for individual site requirements.

Battery Systems with an integrated D.C. Distribution board where the charger can be replaced without disturbing the D.C. Distribution board shall be looked upon favourably in the tender.

In Systems with a separate D.C. distribution board, it shall be possible to locally isolate the distribution board from the battery and charger unit with the aid of a lockable isolation switch.

Termination for outgoing distribution cables shall be provided on a terminal block that will then be wired to a fuse way fitted with locknuts and washers.

The number of distribution ways is listed for each type in Section 10, suppliers should identify limits to number of ways that can be supplied with each design and incremental option costs for additional ways (for ratings of fuses already listed for the application type).

9.8.6 Fuses and Links

Battery connections and all distribution ways shall be fitted with Fuse Holders and protected with appropriately rated HRC fuses. Fuses and Links, shall be cartridge type, BS88 and comply with ENA TS 50-18 Clause 6, IEC 60269-1.

Fuse bases and associated carriers intended to accommodate a fuse link shall be of clearly distinguishable colour. Fuse bases and associated fuse carriers intended to accommodate a solid – link (non-fusible link) shall be coloured white. Each battery string shall be fused on both the positive and negative poles for all applications.

Systems offered shall be adequately protected as to withstand the maximum battery short circuit current appropriate to the battery (set) offered BS EN 60896-22: Clause 6.3.

All STL Chargers shall be provided with a spare set of Battery Fuses secured to the internal side of the charger front panel door.

9.8.7 D.C. Temporary Connections Way

Anderson SB175 or equivalent Sockets for connection of temporary supplies or test loads shall be provided for Battery Systems Distributions where this requirement is identified as per section 10. These D.C. Sockets shall be 2 Connector Multi-pole Type, of a size and rating appropriate to the associated D.C. System, mounted such that associated plugs cannot be fitted incorrectly. Full details of the proposed make and type should be included in tender for approval.

Sockets shall be provided on the distribution board busbars and shall have labels affixed stating **"Connections shall only be made to the input socket where there is adequate source protection on the incoming supply and the supply is equal in voltage to the battery and charger system to which it is being connected".**

Sockets shall be provided feeder side of the outgoing tripping supplies derived from a tap off from a higher voltage battery where this arrangement is provided. Associated sockets shall have labels affixed stating **"Connections shall only be made to the input socket where there is adequate source protection on the incoming supply and after the outgoing way has been isolated from the battery and charger system".**

Additionally, sockets may be supplied downstream of battery fuse ways for battery testing purposes at the option of the tenderer.

9.8.8 D.C. Load Disconnection

All primary substations STL battery systems which support a standing D.C. load shall be constructed such that controllers for disconnecting selected D.C. loads can be easily integrated into the battery and charger system as required. The requirements of Load disconnection control systems that may be added are specified in BATT-03-003.

The minimum requirement within associated battery charger systems shall be the provision of a removable bolted link on the Positive D.C. Busbar with terminals provided such that suitably rated wiring can be installed in parallel with a device capable of making/breaking load when the linking bar is removed. Systems shall be provided such that fuse ways (D.C. loads) can be selectively disconnected on applications where the distributions board is integrated with the battery charger system and provided as a separate board. On separate D.C distributions boards, linking and isolation shall be arranged such that it is possible to completely back feed the D.C distribution board from a single connection and fully isolate it from the battery and charger. Further detail can be found in equipment schedules, section 10.

9.9 Testing

9.9.1 Charger Transformer and Circuit Insulation

The insulation between windings, screen, core and frame of the transformer and circuits directly connected to the 230V A.C. shall withstand 2 kV A.C. rms, 50 Hz for one minute. Immediately afterwards the insulation resistance measured at 500 volts D.C. shall not be less than 20 MΩ.

All circuits intended to be connected to the 230 V A.C. supply shall withstand 2 kV A.C. rms., 50 Hz for one minute. Immediately afterwards the insulation resistance measured at 500 V D.C. shall not be less than 20 MΩ.

9.9.2 Environmental Testing Requirements

Reference should be made to IEC 61000-4 EMC compatibility testing. The vendor shall also demonstrate that Charger Control and Alarm Modules offered as part of the overall solution meet adequate Electrical Environment and EMC Requirements by completing Tables in Schedule B3.

The list of the tests to be completed are taken from ENA TS 48-5 however it is acceptable that Vendor equipment offered is tested to equivalent test procedures. The procedure used for each test must be confirmed, along with specified and actual test levels, compliance statements and acceptance criteria where appropriate.

Specifically, electronic circuitry shall be type tested by application of 5 kV full standard lightning impulse with 1.2/50 µS characteristics as defined in BS 923 (or equivalent). Three positive and three negative impulses shall be applied as follows:

- Between the output terminals with the battery connected;
- Between the output terminals connected together and earth, with the input terminals earthed; and
- Between the input terminals connected together and earth, with the output terminals earthed.

After the above tests, there shall be no indication of failure and the charger shall still provide the required performance. The insulation resistance between the electronic circuitry and earth when measured at 500 V D.C. shall not be less than 20 MΩ.

The psophometric noise level of the complete TEL systems shall not exceed the equivalent emf of 2 mV rms at a frequency of 800 Hz after weighting as specified by ITU-T, and shall not exceed an emf of 10 mV in the frequency range 25 Hz to 5 kHz as specified in ETS 300 132-2.

10. BATTERY SYSTEMS INDIVIDUAL REQUIREMENT SCHEDULES

Battery System Type(s)	**S-ST-30**		**S-ST-48**
Voltage	30V		48V
Description	Unmonitored 30V Switch Tripping Only Battery System		Unmonitored 48V Switch Tripping Only Battery System
Charger Output	~0.5A		~0.5A
Capacity Requirements	5Ahr Capacity		5Ahr Capacity
Charger Setting Range	Charge setting range shall be adjustable such to enable all currently available batteries of the required capacity to be installed with the charger at batteries manufacturers advised settings ranges. Where temperature compensated chargers are offered ambient temperatures range shall be -10°C – 25°C.		
Internal Discharge Requirements	The value of Internal Discharge on loss of A.C. supply via the charger with no load connected shall not exceed 0.25mA		
Cabinet Requirements	Type		Wall Mounted
	Maximum Dimensions Guidance		400W/300D/500H
	Cable Entry Requirements		2 x 20mm with Gland plate (2 each top left and right sides) pre-drilled and covered
Charger Fittings	Item	Description	
Meters (Section 9.7)	Voltmeter	Shall give indications of voltage across charger/battery output terminals (On Push Button Acceptable)	
	Ammeter	Shall Indicate Charge and Discharge Currents	
Manual Switches (Section 9.7.4)	Test Switch	Dedicated Push Button Self Reset Type Controlling a battery test load which disconnects or lower charger output when pressed	
Alarm Requirements	No Alarms Required		
A.C. Input	Shall be fitted with appropriately rated 2 pole MCB		
Battery and D.C. Ways Requirements	System Fused only at Battery with 20A fuse ways for single outgoing way Red and Black Anderson Genderless Powerpole Type sockets to be provided to connect battery main terminals		

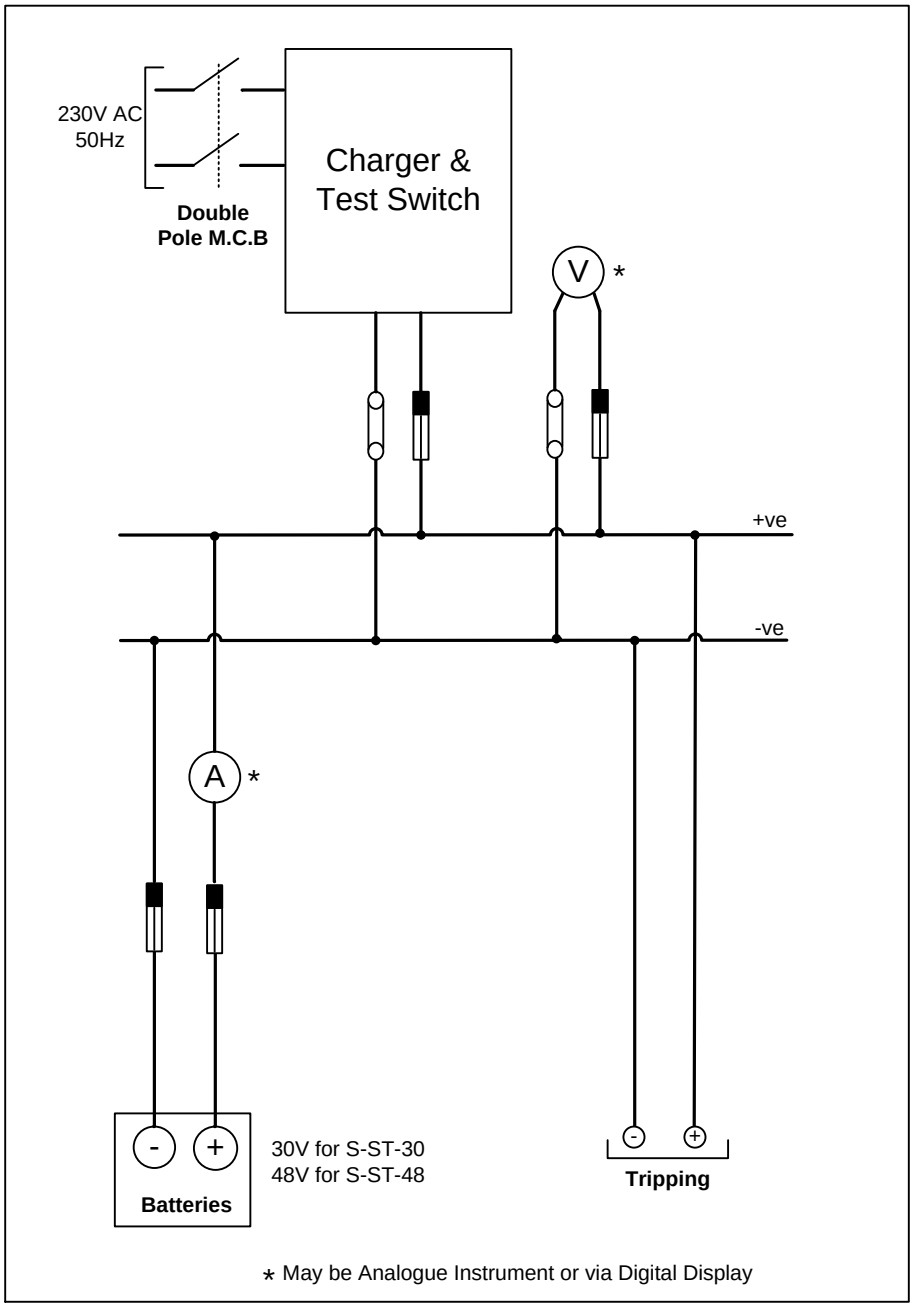


Figure 1: Schematic of S-ST-48 and S-ST-30 Type Systems

Battery System Type	**S-STL-48-Y(X)**		**S-STL-110-Y(X)**	
Voltage	48V		110V (108V 54 Cells)	
Description	48V Switch Tripping and Load Supporting Battery System		110V Switch Tripping and Load Supporting Battery System	
Charger Output	5A		8A	
Battery Accommodation	Up to 40Ahr		Up to 60Ahr	
Internal Discharge Requirements	The value of Internal Discharge on loss of A.C. supply via the charger with no load connected shall not exceed 25mA			
Cabinet Requirements	Type		Wall Mounted where possible	
	Cable Entry Requirements		20mm x 8 Top and Bottom Entry with Gland Plates pre-drilled and covered	
Charger Fittings	Item	Description		
Meters (Section 9.7)	Voltmeter	Shall give indications of voltage across charger/battery output terminals		
	Ammeter	Shall Indicate Charge and Discharge Currents		
	Ammeter	Shall Indicate the System Load (total outgoing ways)		
Manual Switches (Section 9.7.3) (Section 9.7.4)	Test Switch	Dedicated Push Button Self Reset Type Controlling a battery test load which disconnects or lower charger output when pressed		
	HV Shutdown Reset Switch	High Voltage Charger Shutdown and Manual Reset Required		
Deep Discharge Protection (Option)	Contactor	Contactor to remove all load when the battery is entering deep discharge and reconnector load when charger supply re-established		
Indications and Alarms	Condition	Possible Local Indication LED Grouping	SCADA Alarm Grouping	
Conditions to be Detected and Presented (Section 9.7.5)	Asymmetry	Battery Fail	Urgent	
	Impedance			
	Auto–Test (Battery Fail)			
	High Volts	Charger / Supply Fail		
	Low Volts			
	Rectifier fail			
	Mains Fail			
	Earth Fault (+ve)	Earth Fault	Non-Urgent	
	Earth Fault (-ve)			
Auto Test Facility (Section 9.7.1)	Facility to automatically test the battery sets by switching charger output down and the standing supplying load (only)			
A.C. Input	Shall be fitted with appropriately rated 2 pole MCB			
D.C. Ways Requirements (Section 9.8.5 – Section 9.8.6)	Each Way shall be fitted with Fuse Holders and protected with appropriately rated HRC fuses			
	D.C. Ways	D.C. Inputs	D.C. Distribution Ways	
	Rating	N/A	32A	
	Quantity	0	1	

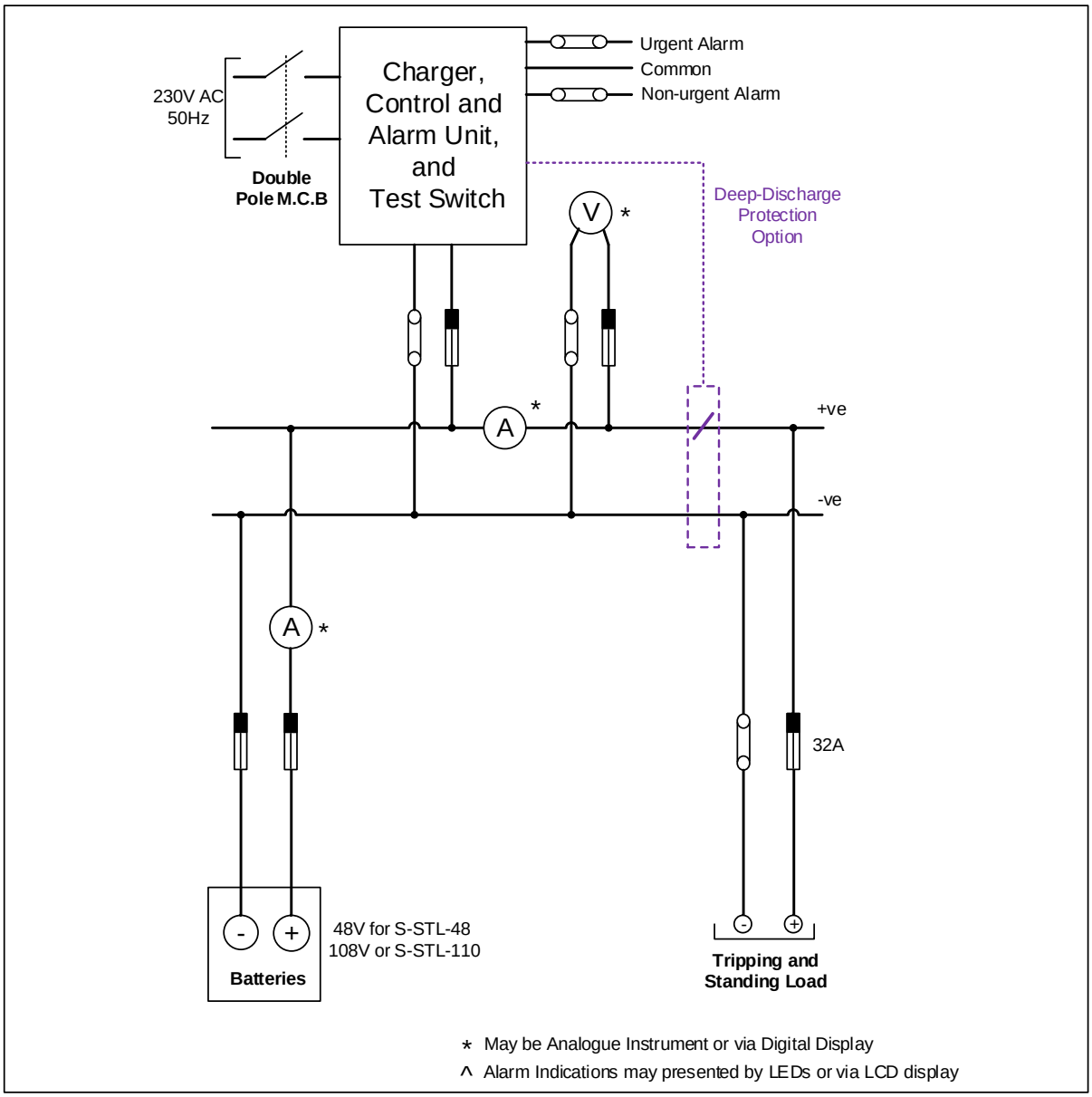


Figure 2: Schematic for S-STL-48-Y(X) and S-STL-110-Y(X)

Battery System Type	P-STL-30-Y(X)				
Voltage	30V				
Description	Monitored 30V Switch Tripping and Load Supporting Battery System				
Charger Output	15A				
Battery Accommodation	Up to 130Ahr				
Internal Discharge Requirements	The value of Internal Discharge on loss of A.C. supply via the charger with no load connected shall not exceed 25mA				
Cabinet Requirements	Type	Free Standing			
	Cable Entry Requirements	20mm x 8 Top and Bottom Entry with Gland Plates pre-drilled and covered			
	Provision should be made to accommodate a future load disconnection device within the cabinet, minimum rack space of 4u height				
Charger Fittings	Item	Description			
Meters (Section 9.7)	Voltmeter	Shall give indications of voltage across charger/battery output terminals			
	Ammeter	Shall Indicate Charge and Discharge Currents			
	Ammeter	Shall Indicate the System Load (total outgoing ways)			
Manual Switches (Section 9.7.3) (Section 9.7.4)	Test Switch	Dedicated Push Button Self Reset Type Controlling a battery test load which disconnects or lower charger output when pressed			
	HV Shutdown Reset Switch	High Voltage Charger Shutdown and Manual Reset Required			
Indications and Alarms	Condition	Possible Local Indication LED Grouping	SCADA Alarm Grouping		
Conditions to be Detected and Presented (Section 9.7.5)	Asymmetry	Battery Fail	Urgent		
	Impedance				
	Auto –Test (Battery Fail)				
	High Volts	Charger / Supply Fail			
	Low Volts				
	Rectifier fail				
	Mains Fail				
	Earth Fault (+ve)	Earth Fault	Non-Urgent		
	Earth Fault (-ve)				
Voltage Monitoring (Section 9.7.6)	The Voltage Across each battery set shall be monitored and transmitted remotely				
Auto Test Facility (Section 9.7.1)	Facility to automatically test the battery sets by switching charger output down and the standing supplying load (only)				
A.C. Input	Shall be fitted with appropriately rated 2 pole MCB				
D.C. Ways Requirements (Section 9.8.5 – Section 9.8.8)	Each Way shall be fitted with Fuse Holders and protected with appropriately rated HRC fuses				
	D.C. Input with 2 Connector Multi-pole Type Socket for connection an alternative D.C. supply or Test Load, Anderson SB175 or equivalent				
	Removable Bolted link on Positive D.C. Bus with terminals for integration future of a load disconnection system				
	D.C. Ways	D.C. Inputs	D.C. Distribution		
			Upstream of Disconnection Link	Downstream of Disconnection Link	
	Rating	Unfused	32A	32A	16A
	Quantity	1	1	1	1

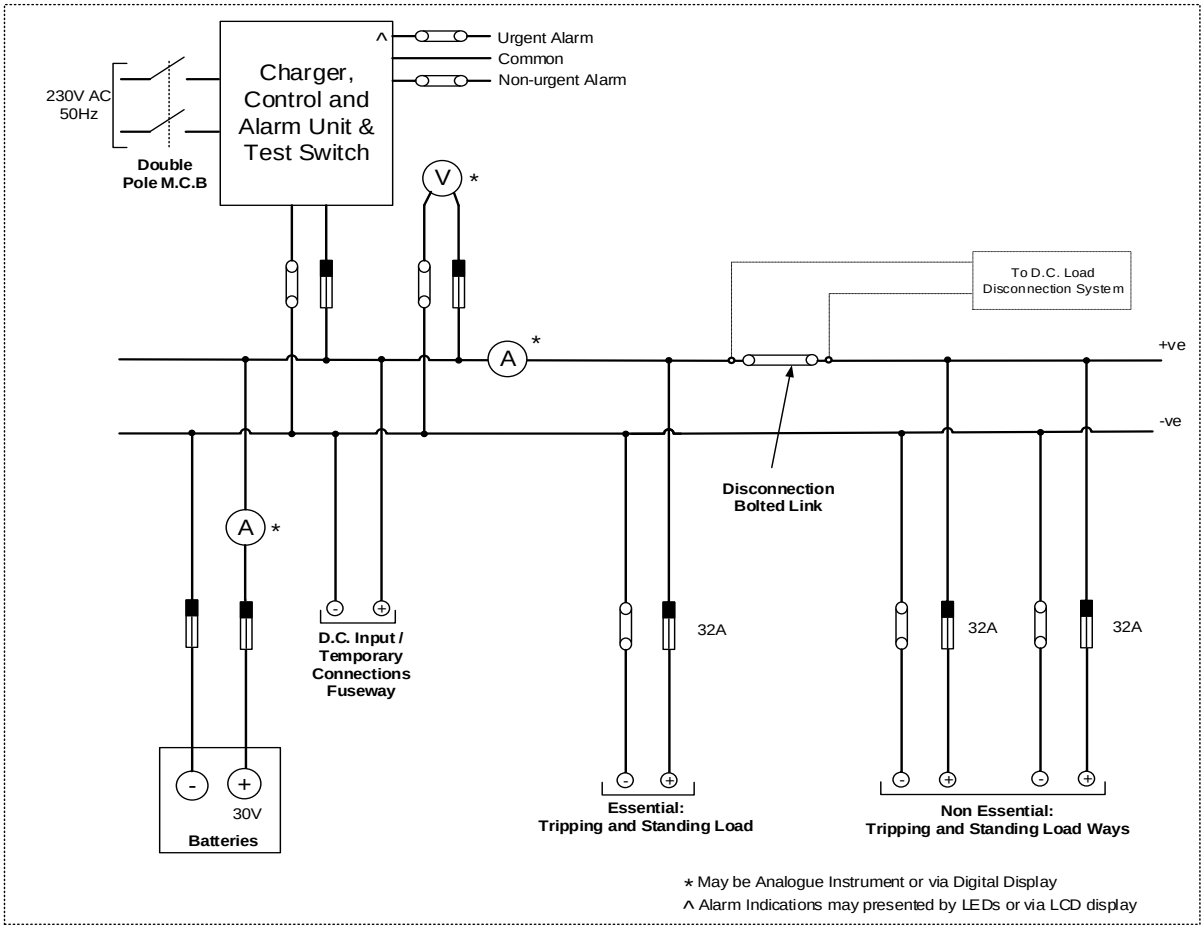


Figure 3: Schematic of P-STL-30-Y(X) Systems

Battery System Types	**P-STL-48-Y(X)** & **P-STL-48/36-Y(X)** (2 Variants)						
Voltage	48V with 30V tap off (Tripping Only)						
Description	Monitored 48V Switch Tripping and Load Supporting Battery System with option of 36V tapping fully rated for switch tripping.						
Variant	A				B		
Charger Output	15A				20A		
Battery Accommodation	Up to 130Ahr				Up to 180Ahr		
Internal Discharge Requirements	The value of Internal Discharge on loss of A.C. supply via the charger with no load connected shall not exceed 25mA						
Cabinet Requirements	Type	Free Standing					
	Cable Entry Requirements	20mm x 8 Top and Bottom Entry with Gland Plates pre-drilled and covered					
	Provision should be made to accommodate a future load disconnection device within the cabinet, minimum rack space of 4u height						
Charger Fittings	Item	Description					
Meters (Section 9.7)	Voltmeter	Shall give indications of voltage across charger/battery output terminals					
	Ammeter	Shall Indicate Charge and Discharge Currents					
	Ammeter	Shall Indicate the System Load (total outgoing ways)					
Manual Switches (Section 9.7.3) (Section 9.7.4)	Test Switch	Dedicated Push Button Self Reset Type Controlling a battery test load which disconnects or lower charger output when pressed					
	HV Shutdown Reset Switch	High Voltage Charger Shutdown and Manual Reset Required					
Indications and Alarms	Condition	Possible Local Indication LED Grouping	SCADA Alarm Grouping				
Conditions to be Detected and Presented (Section 9.7.5)	Asymmetry	Battery Fail	Urgent				
	Impedance						
	Auto–Test (Battery Fail)						
	High Volts	Charger / Supply Fail					
	Low Volts						
	Rectifier fail						
	Mains Fail						
	Earth Fault (+ve)	Earth Fault	Non-Urgent				
	Earth Fault (-ve)						
Voltage Monitoring (Section 9.7.6)	The Voltage Across each battery set shall be monitored and transmitted remotely.						
Auto Test Facility (Section 9.7.1)	Facility to automatically test the battery sets by switching charger output down and the standing supplying load (only)						
A.C. Input	Shall be fitted with appropriately rated 2 pole MCB						
D.C. Ways Requirements (Section 9.8.5 – Section 9.8.8)	Each Way shall be fitted with Fuse Holders and protected with appropriately rated HRC fuses						
	D.C. Input with 2 Connector Multi-pole Type Socket for connection an alternative D.C. supply or Test Load, Anderson SB175 or equivalent						
	Removable Bolted link on Positive D.C. Bus with terminals for integration future of a load disconnection system						
	D.C. Ways	D.C. Inputs	D.C. Distribution				
			Upstream of Disconnection Link			Downstream of Disconnection Link	
	Rating	Unfused	**36V - 32A**	48V - 6A	48V - 32A	32A	16A
	Quantity	1 – 48V **1 – 36V**	**1(*)**	1	1	1	1

(*) NB: Additional Fuse ways and D.C Inputs required for P-STL-48/36 systems in Blue

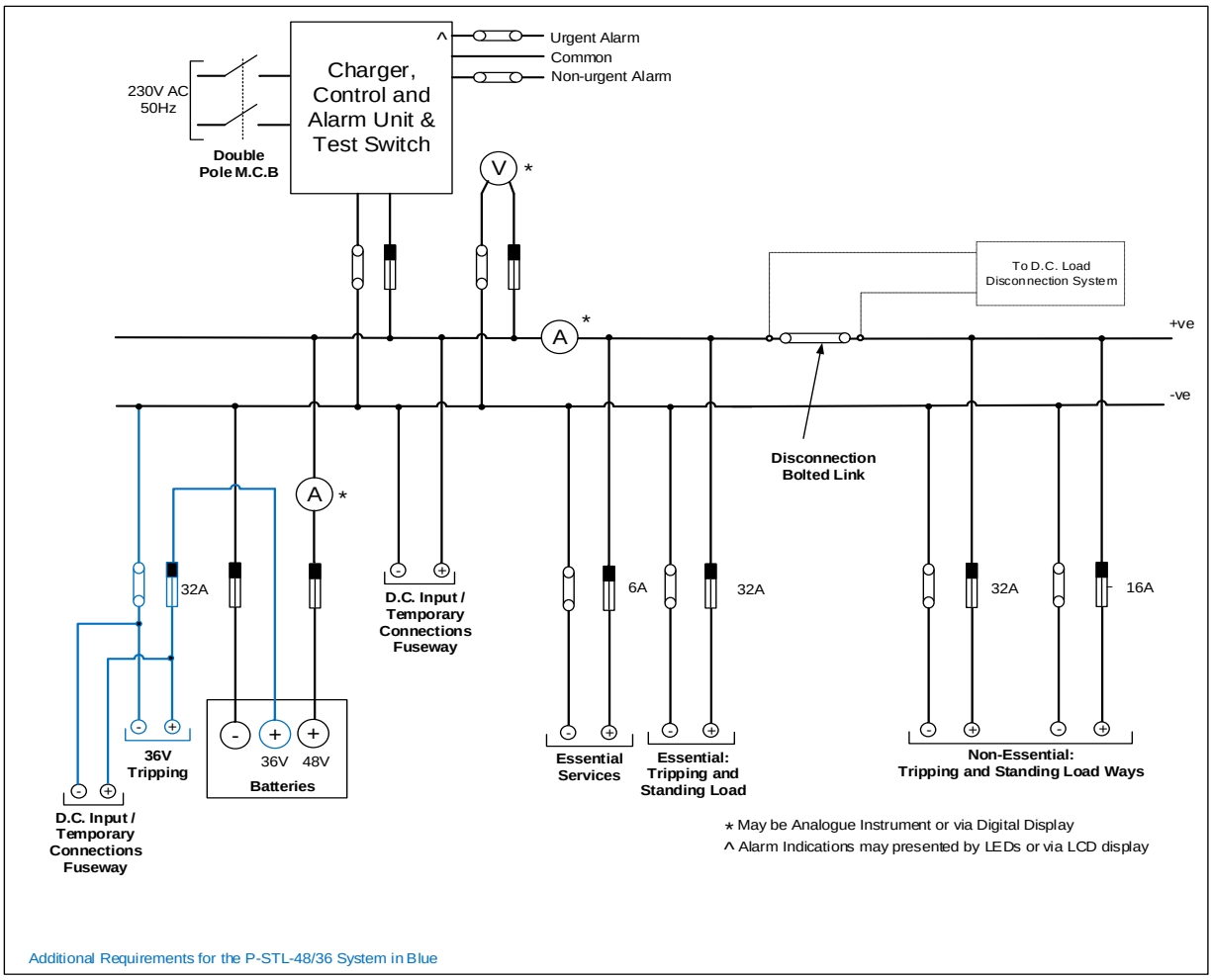


Figure 4: Schematic of P-STL-48-Y(X) & P-STL-48/36-Y(X) Systems

<table>
<tr><td>Battery System Types</td><td colspan="6">P-STL-110-Y(X), P-STL-110-Y(X)&SD, P-STL-110/36-Y(X), P-STL-110/36-Y(X)&SD Systems</td></tr>
<tr><td>Voltage</td><td colspan="6">110V (108V – 54 Cells)</td></tr>
<tr><td>Description</td><td colspan="6">Monitored 110V Switch Tripping and Load Supporting Battery System.
With option for with 36V tap off fully rated for switch tripping.</td></tr>
<tr><td>Variant</td><td colspan="2">A</td><td colspan="2">B</td><td colspan="2">C</td></tr>
<tr><td>Charger Output</td><td colspan="2">15A</td><td colspan="2">25A</td><td colspan="2">30A</td></tr>
<tr><td>Battery Accommodation</td><td colspan="2">Up to 125Ahr</td><td colspan="2">Up to 190Ahr</td><td colspan="2">Up to 250Ahr</td></tr>
<tr><td>Internal Discharge Requirements</td><td colspan="6">The value of Internal Discharge on loss of A.C. supply via the charger with no load connected shall not exceed 25mA</td></tr>
<tr><td rowspan="3">Cabinet Requirements</td><td>Type</td><td colspan="5">Free Standing (Distribution Board Wall Mounted if separate)</td></tr>
<tr><td>Cable Entry Requirements</td><td colspan="5">20mm x 8 Top and Bottom Entry with Gland Plates pre-drilled and covered (5 or greater for Distribution Board in addition to the charger if separate)</td></tr>
<tr><td colspan="6">Provision should be made to accommodate a future load disconnection device within the cabinet, minimum rack space of 4u height</td></tr>
<tr><td>Charger Fittings</td><td>Item</td><td colspan="5">Description</td></tr>
<tr><td rowspan="2">Meters

(Section 9.7)</td><td>Voltmeter</td><td colspan="5">Shall give indications of voltage across charger/battery output terminals</td></tr>
<tr><td>Ammeter</td><td colspan="5">Shall Indicate Charge and Discharge Currents</td></tr>
<tr><td rowspan="2">Manual Switches

(Section 9.7.3)
(Section 9.7.4)</td><td>Ammeter</td><td colspan="5">Shall Indicate the System Load (total outgoing ways)</td></tr>
<tr><td>Test Switch</td><td colspan="5">Dedicated Push Button Self Reset Type Controlling a battery test load which disconnects or lower charger output when pressed</td></tr>
<tr><td>Indications and Alarms</td><td>HV Shutdown Reset Switch</td><td colspan="5">High Voltage Charger Shutdown and Manual Reset Required</td></tr>
<tr><td rowspan="9">Conditions to be Detected and Presented

(Section 9.7.5)</td><td>Condition</td><td colspan="2">Possible Local Indication LED Grouping</td><td colspan="3">SCADA Alarm Grouping</td></tr>
<tr><td>Asymmetry</td><td colspan="2" rowspan="3">Battery Fail</td><td colspan="3" rowspan="7">Urgent</td></tr>
<tr><td>Impedance</td></tr>
<tr><td>Auto–Test (Battery Fail)</td></tr>
<tr><td>High Volts</td><td colspan="2" rowspan="4">Charger / Supply Fail</td></tr>
<tr><td>Low Volts</td></tr>
<tr><td>Rectifier fail</td></tr>
<tr><td>Mains Fail</td></tr>
<tr><td>Earth Fault (+ve) & (-ve)</td><td colspan="2">Earth Fault</td><td colspan="3">Non-Urgent</td></tr>
<tr><td>Voltage Monitoring (Section 9.7.6)</td><td colspan="6">The Voltage Across each battery set shall be monitored and transmitted remotely</td></tr>
<tr><td>Auto Test Facility (Section 9.7.1)</td><td colspan="6">Facility to automatically test the battery sets by switching charger output down and the standing supplying load (only)</td></tr>
<tr><td>A.C. Input</td><td colspan="6">Shall be fitted with appropriately rated 2 pole MCB</td></tr>
<tr><td rowspan="6">D.C. Ways Requirements

(Section 9.8.5 – Section 9.8.8)</td><td colspan="6">Each Way shall be fitted with Fuse Holders and protected with appropriately rated HRC fuses</td></tr>
<tr><td colspan="6">D.C. Input with 2 Connector Multi-pole Type Socket for connection an alternative D.C. supply or Test Load, Anderson SB175 or equivalent</td></tr>
<tr><td colspan="6">Removable Bolted link on Positive D.C. Bus with terminals for integration future of a load disconnection system</td></tr>
<tr><td rowspan="2">D.C. Ways</td><td rowspan="2">D.C. Inputs</td><td colspan="4">D.C. Distribution</td></tr>
<tr><td colspan="2">Upstream of Disconnection Link</td><td colspan="2">Downstream of Disconnection Link</td></tr>
<tr><td>Rating</td><td>TBC</td><td>36V-32A</td><td>110V-32A</td><td>110V-32A</td><td>110V-16A</td></tr>
<tr><td>Quantity</td><td>1 – 48V
1 – 36V</td><td>1(*)</td><td>2/3(^)</td><td>2 /3(^)</td><td>1</td></tr>
</table>

(*) NB: Additional Fuse ways requires for P-STL-110/36 systems in Blue
(^) Additional essential and non-essential ways fuse way for options with separate distribution boards.

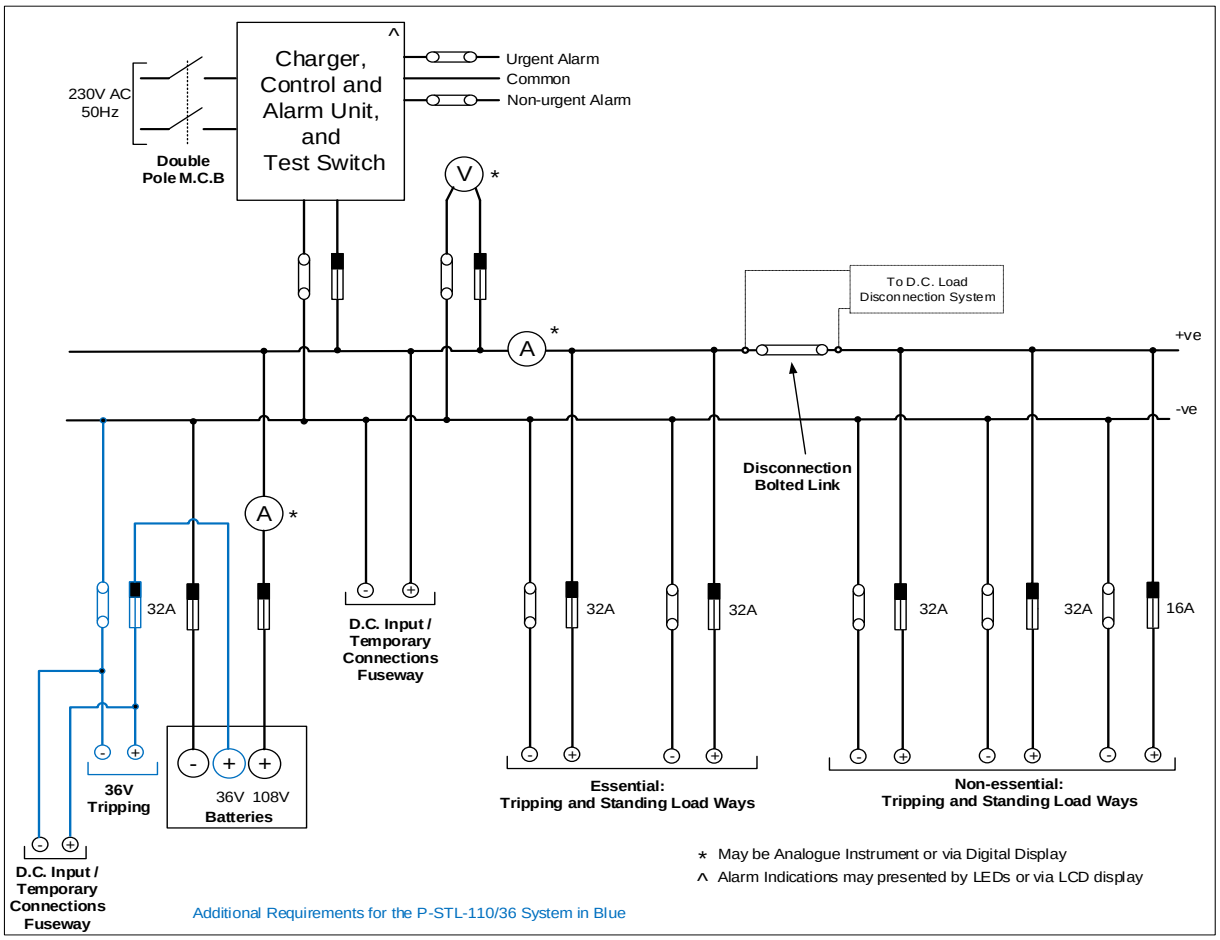


Figure 5: Schematic of P-STL-110-Y(X) & P-STL-110/36-Y(X) Battery Systems

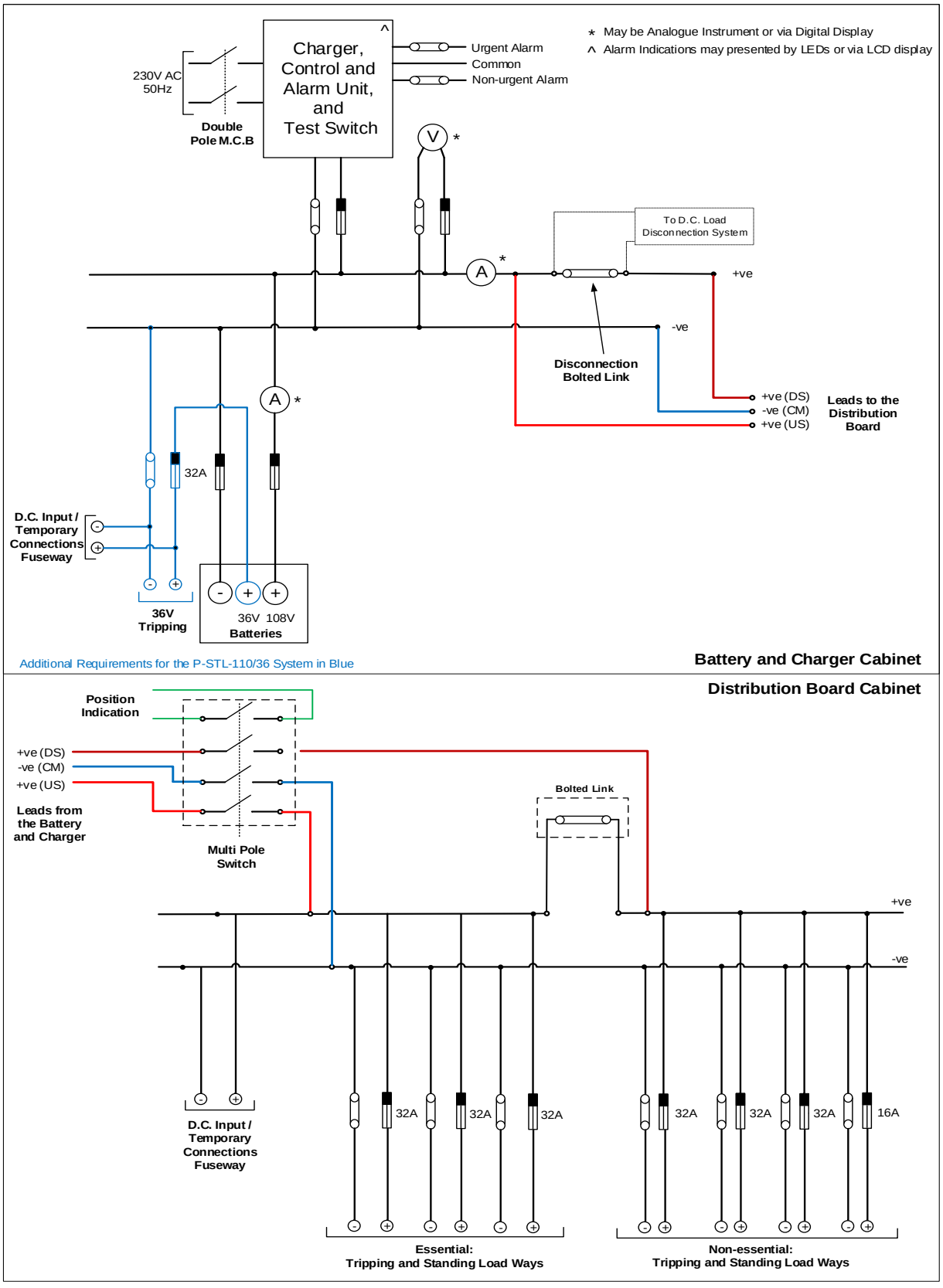


Figure 6: Schematic of P-STL-110-Y(X)&SD & P-STL-110/36-Y(X)&SD Battery Systems

Battery System Type	P-TEL-48 (Variant A 5A)			
Voltage	48V			
Description	Telecoms and SCADA Load Supporting Positively Earthed Battery System.			
Variant	A			
Charger Output	5A			
Battery Accommodation	Up to 40Ahr			
Cabinet Requirements	19' Rack Mounted - charger and batteries should take no more than 10U in height			
Charger Fittings	Item	Description		
Meters (Section 9.7)	Voltmeter	Shall give indications of voltage across charger/battery output terminals		
	Ammeter	Shall Indicate Charge and Discharge Currents		
	Ammeter	Shall Indicate the System Load (total outgoing ways)		
Manual Switches (Section 9.7.3) (Section 9.7.4)	Test Switch	Dedicated Push Button Self Reset Type Controlling a battery test load which disconnects or lower charger output when pressed		
	HV Shutdown Reset Switch	High Voltage Charger Shutdown and Manual Reset Required		
Deep Discharge Protection (Option)	Contactor	Contactor to remove all load when the battery is entering deep discharge and reconnector load when charger supply re-established		
Indications and Alarms	Condition	Possible Local Indication LED Grouping	SCADA Alarm Grouping	
Conditions to be Detected and Presented (Section 9.7.5)	Asymmetry	Battery Fail	Urgent	
	Impedance			
	Auto–Test (Battery Fail)			
	High Volts	Charger / Supply Fail		
	Low Volts			
	Rectifier fail			
	Mains Fail			
	Deep Discharge Protection Operated (where applicable)			
	Fuse Fail	Fuse Fail		
Voltage Monitoring (Section 9.7.6)	The Voltage Across each battery set shall be monitored and transmitted remotely in either of the following formats as required 0 – 10mA or 4 – 20mA			
Auto Test Facility (Section 9.7.1)	Facility to automatically test the battery sets by switching charger output down and the standing supplying load (only)			
A.C. Input	Shall be fitted with appropriately rated 2 pole MCB			
D.C. Ways Requirements (Section 9.8.5 – Section 9.8.6)	Each Way shall be fitted with Fuse Holders and protected with appropriately rated HRC fuses			
	D.C. Ways	D.C. Inputs	D.C. Distribution	
	Rating	N/A	1A	2A
	Quantity	0	1	1
Other Requirements	Positive terminal of battery systems shall be earthed.			

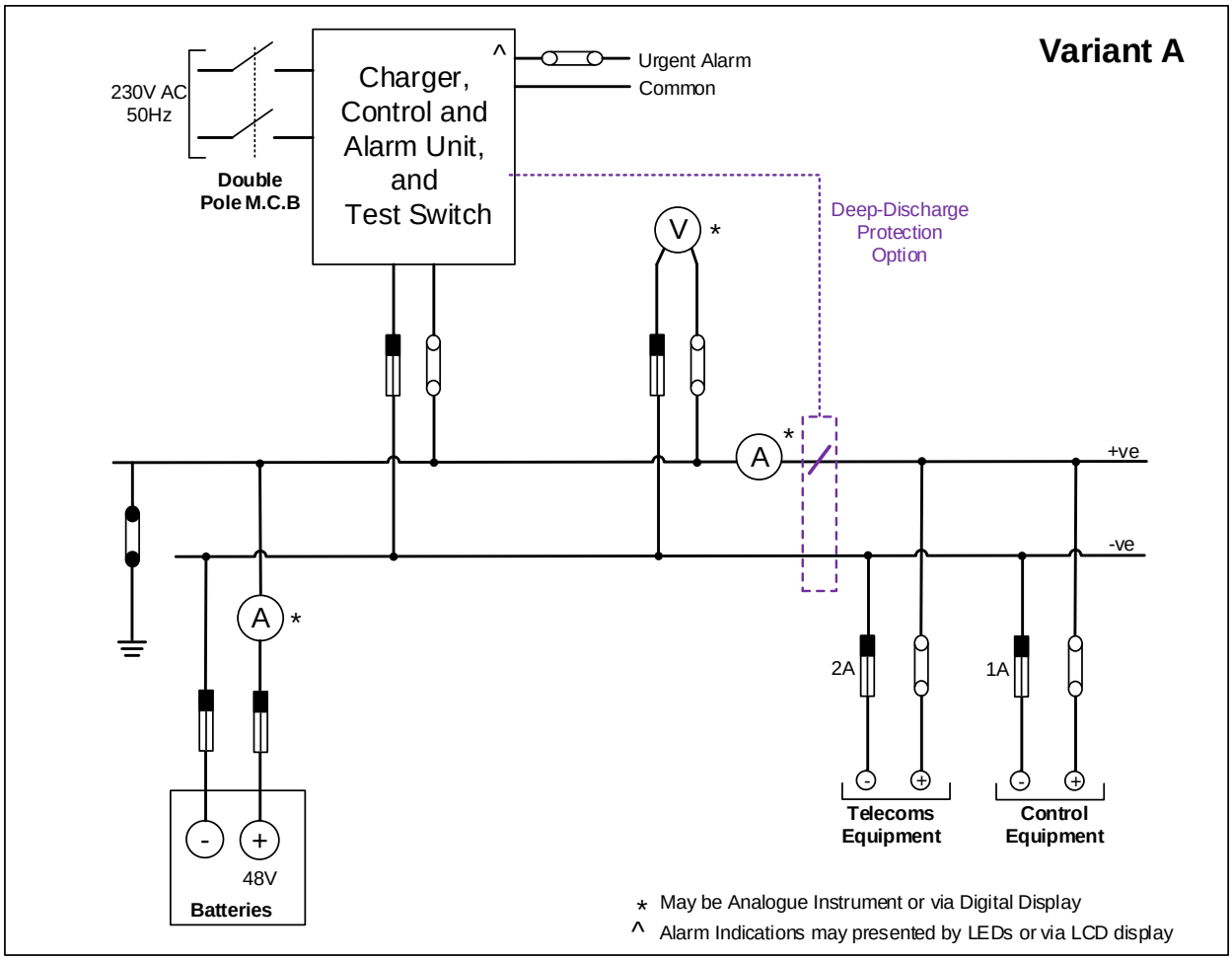


Figure 7: Schematic of P-TEL-48 (Variant A)

Battery System Type	P-TEL-48 (Variant B 13A & C 25A)			
Voltage	48V			
Description	Telecoms and SCADA Load Supporting Positively Earthed Battery System.			
Variant	B		C	
Charger Output	13A		25A	
Battery Accommodation	Up to 100Ahr		Up to 180Ahr	
Cabinet Requirements	Type	Free Standing and 19' Rack Mounted Variants Required		
	Rack Mounted	Guide Dimensions Charger and Batteries should take no more than 21U in height		
	Free Standing	Cable Entry Requirements Guide Dimensions H 2000mm / W 600mm / 600mm		
		20mm x 6 Top and Bottom Entry with Gland Plates pre-drilled and covered		
Charger Fittings	Item	Description		
Meters (Section 9.7)	Voltmeter	Shall give indications of voltage across charger/battery output terminals		
	Ammeter	Shall Indicate Charge and Discharge Currents		
	Ammeter	Shall Indicate the System Load (total outgoing ways)		
Manual Switches (Section 9.7.3) (Section 9.7.4)	Test Switch	Dedicated Push Button Self Reset Type Controlling a battery test load which disconnects or lower charger output when pressed		
	HV Shutdown Reset Switch	High Voltage Charger Shutdown and Manual Reset Required		
Indications and Alarms	Condition		Possible Local Indication LED Grouping	SCADA Alarm Grouping
Conditions to be Detected and Presented (Section 9.7.5)	Fuse Fail		Fuse Fail	Urgent
	Asymmetry		Battery Fail	
	Impedance			
	Auto–Test (Battery Fail)			
	High Volts		Charger / Supply Fail	
	Low Volts			
	Mains Fail			
	Deep Discharge Protection Operated (where applicable)			
	Rectifier fail			
Voltage Monitoring (Section 9.7.6)	The Voltage Across each battery set shall be monitored and transmitted remotely in either of the following formats as required 0 – 10mA or 4 – 20mA			
Auto Test Facility (Section 9.7.1)	Facility to automatically test the battery sets by switching charger output down and the standing supplying load (only)			
A.C. Input	Shall be fitted with appropriately rated 2 pole MCB			
D.C. Ways Requirements (Section 9.8.5 – Section 9.8.7)	Each Way shall be fitted with Fuse Holders and protected with appropriately rated HRC fuses			
	D.C. Input with 2 Connector Multi-pole Type Socket for connection an alternative D.C. supply or Test Load, Anderson SB175 or equivalent			
	D.C. Ways	D.C. Inputs	D.C. Distribution	
	Rating	TBC	6A	
	Quantity	1	6	
Other Requirements	Positive terminal of battery systems shall be earthed.			

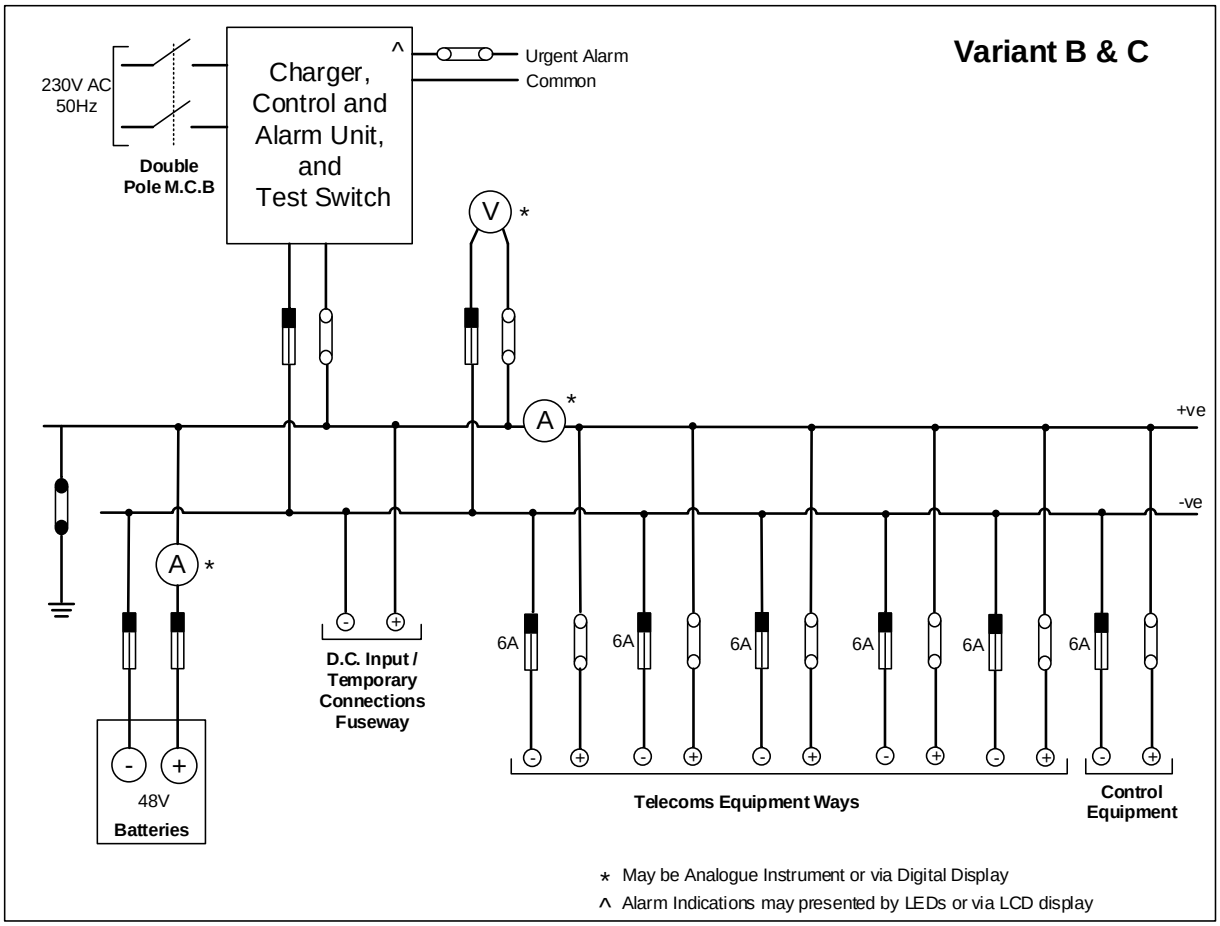


Figure 8: Schematic of P-TEL-48 (Variant B & C)

11. WORKS INSPECTION

On receipt of the order, the Tenderer shall immediately agree with the Company a provisional dated programme for witnessing of the works testing and inspection. The Company require a minimum of three weeks' notice to confirm the test and inspection programme date.

12. COMMISSIONING, OPERATION AND MAINTENANCE MANUAL

A Commissioning, Operation and Maintenance Manual shall be provided with each charger. The manual shall include a copy of the following drawings:

- Wiring diagram for the complete equipment;
- Circuit diagram for the charger chassis, detailing the value and types of the electronic components. Such components may alternatively be detailed on a separate component list;
- Circuit diagram for the high/low voltage relay;
- Full test instructions for provision of all required alarm function on site at time of commissioning and any future maintenance / fault faulting;
- A general fault finding guide.

The manuals/drawings shall be approved by the Engineer

13. APPROVAL

Following approval of any item, no change shall be made by the manufacturer without the written agreement of the Engineer.

14. QUALITY REQUIREMENTS

Analysis of defective items on receipt and in use will be used to assist in subsequent tender analysis.

14.1 Quality Assurance

Manufacturers shall operate a fully documented quality assurance system and should indicate with their tenders the QA Approvals granted to the manufacturer.

14.2 Progress and Inspection Requirements

Access to the supplier's or Sub-Contractor's works shall be granted, at any reasonable time, to allow the engineering staff to verify the progress status of the work.

14.3 Quality Plans/Inspection Checklists

The supplier shall submit to the Company, before the commencement of design/manufacture, quality plans/inspection checklists for "mark-up" of the Company's requirements with respect to document approval and quality control activities.

Two copies of all approved documents shall be supplied to the Company.

14.4 Inspection and Witnessing of Tests

The Engineer shall carry out, where appropriate, inspections and witness routine tests in accordance with the "mark-up" on the approved quality plans/inspection checklists and agreed test programme.

The supplier shall give seven days' notice of his intention to carry out any witness points referenced on the quality plans/inspection checklists.

14.5 Retention of Quality Records

The supplier shall maintain the quality records in an area of safe deposit for a minimum period of 10 years and not dispose of these records without prior agreement of the Company. During the retention period, copies of the quality records shall be made available to the Company on request.

14.6 Certificate of Conformance

The supplier shall provide a certificate of conformance for each item that required a quality plan/inspection checklist and will be signed by the supplier's nominated representative.

This document shall reference the quality plan/inspection checklist, the quality records being retained, the supplier's unique identification and the Company's order number.

In addition, any certification required to meet the statutory requirements for pressure parts/lifting equipment shall be issued with the certificate of conformance.

One copy of the certificate of conformance and, where relevant, the statutory certification shall be despatched with the item and a second copy issued to the Company.

A certificate of conformance shall be provided upon completion of each order placed with the successful Tenderer(s), identifying the appropriate technical specifications with which the items comply.

The Tenderer shall submit the following documents with the tender:

- Overall quality policy statement;
- Copies of any formal quality approvals; and
- Quality plans for each item offered (these must identify the control stages during manufacture and test).

15. PROTECTION AND PACKAGING

The Supplier shall ensure that each item is suitably protected and packaged to maintain it “fit for service” before installation.

16. DELIVERY

Tenderers shall state on the Price Schedule the lead times offered on all items.

17. INFORMATION REQUIRED FROM THE TENDERER

The Tenderer is required to complete all the schedules attached to this specification including all the appropriate information in respect of each item offered.

The Tenderer shall return the following additional documentation with copies of the completed schedules at the time of tendering:

Item	Description	Clause
1	Variations from the Primary Standards	7.2, 7.3
2	Equivalents offered	7.3
3	Completion of Technical Schedule B1 (All Batteries offered that are not on SPEN Approved Equipment Register - Batteries)	9.6
4	Certificates of battery classification	9.6
5	Completion of Technical Schedule B2 (All Chargers offered)	9.5
6	Description of Charger Control Design principle	9.5.2
7	Value of discharge from battery to charger when supply is lost	9.5.2
8	Completion of Technical Schedule B3 (All Chargers Controllers and Alarm units offered): Proof of Environmental testing	9.9.2
9	Departures from Specification: Technical Schedule B4	9.2
10	Cabinet layout drawings	9.8.1
11	Manuals and drawings	12
12	Details of quality systems	14.6
13	Completion of Schedule B5: Prices For Battery Systems Types	
14	Completion of Schedule B6: Prices For Battery Sets	
15	Any other information requested elsewhere in this Specification or specifically requested in the Enquiry documents accompanying this Specification.	

18. SCHEDULES TO BE COMPLETED BY TENDERER

18.1 TECHNICAL SCHEDULE B1: BATTERY

Copy to be completed for each battery rating – Schedules required only for Batteries not currently on SPEN Approved Equipment Register - Batteries.

Selected battery Type	
Manufacturer, country of origin and type reference	
Standards with which the battery conforms	
Recommended battery manufacturer man hours of Maintenance required per year	
Guaranteed life span of battery (Life span prediction shall take into account of ambient and cabinet temperatures)	
Nominal voltage	
Normal float voltage	
Dimensions of cells (width x height x depth)	
Material of battery case	
Battery capacity at 10 hour discharge rate	
Current disposal costs per cell	

BS EN 90896-22 Clause	Product specification information						
	Product safe operation in service	**Compliance information mandatory**					
6.1	Gas emission (at float voltage and at 2,40 Vpc)	Float charge voltage			ml Per Cell	Per Hour	Per Ahr
		Over charge voltage			ml Per Cell	Per Hour	Per Ahr
6.2	High current tolerance	Pass / Fail					
6.3	Short circuit current and d.c. internal resistance	Short circuit current					Amps
		Internal Resistance					Ohms
6.4	Internal ignition from external spark sources	Pass / Fail					
6.5	Protection against ground short propensity	Pass / Fail					
6.6	Content and durability of required markings	Pass / Fail					
6.7	Material identification	Pass / Fail					
6.8	Valve operation	Pass / Fail					
	Product performance in service	**Compliance information mandatory or on as-needed basis**					
6.11	Discharge capacity	Data for	c10	c8	c3	c	C0.25
		Pass/ Fail					
6.12	Charge retention during storage	Pass / Fail		Capacity retention (%)			
6.14	Recharge behaviour	Pass / Fail					
	Product durability in service	**Compliance information mandatory or on as-needed basis**					
6.15	Service life at an operating temperature of 40 °C	Value to be requested as function of service environment					years
6.17	Abusive over-discharge Value to be requested if service environment warrants	Caod			Caoc		
6.18	Thermal runaway sensitivity	Pass / Fail					
6.19	Low temperature sensitivity (Freezing Conditions)	Pass / Fail					
6.21	Stability against mechanical abuse of units during installation	Pass / Fail					

18.2 TECHNICAL SCHEDULE B2: CHARGER

Manufacturer, country of origin and type reference			
Maximum physical dimensions			
Width x Height x depth (mm)	W:	H:	D:
Type (Wall / Rack Mounted / Free Standing Panel)			
IP rating			
D.C. output 30V, 48V or 110V: Rectifier Type (Thyristor / Dual Switch Mode) Float voltage Current Output Ripple (%) with Battery Disconnected Charger Life Expectancy (years) Charger Maintenance Requirements / Other Details			
Batteries Compatible with Charger/Enclosure			
Current limitation range			
Voltage limitation range			
Noise level limit			
Time to recharge battery to 90% from fully discharged state (hours) – (Assume Largest Compatible Battery)			
Charger efficiency			
Overload protection			
Deep Discharge Protection Options (where applicable) -> Cost Delta for Solution			
Details of Manual Switches			
Controls, indications and Alarms Modules			
Details of terminations and terminals used			
Details of D.C. Distribution -> Cost Delta for additional Fuse ways			

18.3 TECHNICAL SCHEDULE B3: ENVIRONMENTAL TESTING COMPLIANCE STATEMENTS

Electrical Environmental Requirements

ENA Technical Specification 48-5 Clause	Procedure used for Test	Specified Test Level	Compliance Y or N	Actual Test Level	Remarks / Acceptance Criteria
6.2 – AC Supply Voltage					
6.5.1 – Insulation – Dielectric					
6.5.2 – Insulation – Impulse Voltage					

Electromagnetic Compatibility (EMC) Requirements

ENA Technical Specification 48-5 Clause	Procedure used for Test	Specified Test Level	Compliance Y or N	Actual Test Level	Remarks / Acceptance Criteria
7.1 Oscillatory waves immunity test (High Frequency Disturbance)					
7.2 Electrostatic Discharge immunity tests					
7.3 Radiated electromagnetic field disturbance test (RFI)					
7.4 Electrical fast transient/burst immunity					
7.5 Surge immunity test					
7.6 Conducted electromagnetic field disturbance tests					
7.7.1 Power frequency magnetic field immunity test					
7.7.2 Power frequency General					
7.8 Pulse magnetic field immunity test					
7.9 Damped oscillatory magnetic field immunity test					
7.11 Conducted and Radiated Emission					

18.4 TECHNICAL SCHEDULE B4: DEPARTURES FROM SPECIFICATION

The Tenderer will be deemed compliant with the Specification except to the extent those deviations are stated in this Schedule.

18.5 SCHEDULE B5: PRICES FOR BATTERY SYSTEMS TYPES

Battery System Type	Description		Charger Output	Price	Compatible Batteries
S-ST-30-Y(X)	Wall Mounted Unmonitored 30V Switch Tripping Only Battery System				
S-ST-48-Y(X)	Wall Mounted Unmonitored 48V Switch Tripping Only Battery System				
S-STL-48-Y(X)	Monitored 48V Switch Tripping and Load Supporting Battery System				
	Cost Delta for Deep Discharge Protection Option				
S-STL-110-Y(X)	Monitored 110V Switch Tripping and Load Supporting Battery System				
	Cost Delta for Deep Discharge Protection Option				
P-STL-48-Y(X) **P-STL-48/36-Y(X)**	Monitored 48V Switch Tripping and Load Supporting Battery System	A			
		B			
	Cost Delta for 36V tapping fully rated for switch tripping Option.				
P-STL-110-Y(X) **P-STL-110/36-Y(X)**	Monitored 110V Switch Tripping and Load Supporting Battery System.	A			
		B			
		C			
	Cost Delta for 36V tapping fully rated for switch tripping Option.				
	Cost Delta for additional fuse ways				
P-STL-110-Y(X)&SD **P-STL-110/36-Y(X)&SD**	Monitored 110V Switch Tripping and Load Supporting Battery System (not including the 110V distribution).	A			
		B			
		C			
	Cost Delta for 36V tapping fully rated for switch tripping Option.				
	Cost Delta separate distribution board				
	Cost Delta for additional fuse ways				

Continued

Battery System Type	Description		Charger Output	Price	Compatible Batteries
P-TEL-48	Monitored 48V Telecoms and SCADA Load Supporting Positively Earthed Battery System.	A			
		B			
		C			
	Cost Delta for Deep Discharge Protection Option (System A)				
E-Cab(X)	Extension Cabinet with traying and accommodation for up to 2 sets of 110 (108) V batteries		N/A		

* Prices for associated Batteries to be recorded in table below

18.6 SCHEDULE B6: PRICES FOR BATTERY SETS

Battery					Price	Compatible Battery Systems (Battery/Charger System Reference)
Manufacturer	**Series**	**Model**	**Voltage (per Block)**	**Voltage (of Set)**		

In addition, please confirm costs for conducting commissioning charge on batteries per block and per set