

Electricity Specification 337

Issue 9 September 2023

Specification for Protection and Control Relay Panels



Amendment Summary

ISSUE NO. DATE	DESCRIPTION
Issue 8 FEB 2023	Document converted into new template and updated throughout to reflect details of protection panels, relays and schemes currently in use. Prepared by: Simon Rushton, Stephen Kaliski Approved by: Policy Approval Panel and signed on its behalf by Steve Cox, DSO Director
Issue 9 SEP 2023	Section 5.14 paragraph added to cover provision of schematic diagrams only and updated drawing numbers added to Appendix A Prepared by: Simon Rushton, Stephen Kaliski Approved by: Policy Approval Panel and signed on its behalf by Steve Cox, DSO Director

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1 Scope

This specification covers the general and technical requirements for protection and control relay panels for use in Grid, BSP (Bulk Supply Point) and Primary Substations. The protection and control relay panels are used on the electricity distribution network (Network) owned and operated by Electricity North West Limited, hereafter referred to as Electricity North West Limited.

2 Definitions

ac	Alternating Current
Approval	Sanction by the Electricity North West Limited Protection Systems Manager that specified criteria have been satisfied.
Contract	The agreement between Electricity North West Limited and the Contractor for the execution of the Works including therein all documents to which reference may properly be made in order to ascertain the rights and obligations of the parties under the said agreement.
Contractor	The person or person's firm or company, including personal representatives, successors and permitted assigns, who's Tender has been accepted by Electricity North West Limited.
dc	Direct Current
Specification	The Specifications and schedules (if any) agreed by the parties for the purpose of the Contract.
Sub-Contractor	Any person (other than the Contractor) named in the Contract for any part of the Works or any person to whom any part of the Contract has been sub-let with the consent in writing of the Electricity North West Limited Protection Systems Manager, and the legal representatives, successors and assigns of such person.
Supplier	Any person or person's firm or company who supplies goods to Electricity North West Limited or to its Contractor.
Tender	An offer in writing to execute work or supply goods at a fixed price.
Tenderer	The person or person's firm or company, including personal representatives, successors and permitted assigns, invited by Electricity North West Limited to submit a Tender.
BEF	Balanced Earth Fault. A form of earth fault protection that operates from the summation of 3-phase circuits. This is usually applied to the source end of feeder transformers.
DOC	Directional Overcurrent. A form of overcurrent protection installed on the lower voltage sides of primary transformers that only looks upstream and provides back-up

	protection for 3-phase and phase-to-phase faults in the transformer or on the higher voltage system. Can also be used on incoming feeders to customer supplies where the supply requires multiple feeders operating in parallel.
EF	Earth Fault. Protection that operates when fault current flows to earth within the protected zone.
EI	Extremely Inverse. An inverse definite minimum time protection curve based on a formula defined in BS EN 60255-3.
ENA TS	Electricity Networks Association Technical Specification
HSOC	High Set Overcurrent. A form of overcurrent protection that protects the higher voltage sides of primary transformers. May be installed at the source end of feeder transformers or local to transformers. The protection operates for 3-phase and phase-to-phase faults up to and including the transformer HV winding but not within or beyond the LV winding.
IDMT	Inverse Definite Minimum Time. Protection utilising a relay with an inverse definite minimum time curve. The curves in general use are standard inverse, very inverse, extremely inverse or long time inverse, and are based on formulae defined in BS EN 60255-3.
LED	Light Emitting Diode
LDC	Line Drop Compensation
LTI	Long Time Inverse. An inverse definite minimum time protection curve based on a formula defined in BS EN 60255-3.
NER	Neutral Earthing Resistor. This resistance is applied to the star point of a transformer and is used to restrict earth fault current flowing on the network to specific values, generally 1000A per transformer.
NVD	Neutral Voltage Displacement. Protection designed to detect the displacement of the neutral caused by a grounded overhead line conductor back fed from an unearthed transformer winding.
OC	Overcurrent. Protection that operates when the current flowing into the protected zone exceeds the setting of the protection. The setting is normally chosen to avoid the overloading of plant and circuits.

REF	Restricted Earth Fault. A form of earth fault protection covering a specific “restricted” zone, usually used on the star winding of a transformer. The protection operates by comparing the summation of the current in the 3-phase circuits and the current in the neutral CT. The placement of the CTs defines the “restricted” zone.
SBEF	Standby Earth Fault. A form of earth fault protection installed on the lower voltage sides of grid and primary transformers that provides protection to NERs, busbars and final feeder protection in the event of a ‘stuck breaker’. SBEF protection shall use an inverse time characteristic to ensure appropriate tripping times and discrimination with downstream earth fault protection.
SEF	Sensitive Earth Fault. A form of earth fault protection that detects high impedance earth faults on 11/6.6kV overhead lines. The protection operates from the residual current detected in a circuit for a definite period of time.
SI	Standard Inverse. An inverse definite minimum time protection curve based on a formula defined in BS EN 60255-3. Also known as Normal Inverse by some manufacturers.
VI	Very Inverse. An inverse definite minimum time protection curve based on a formula defined in BS EN 60255-3.
VCOG	Voltage Controlled Overcurrent. A form of overcurrent protection which uses voltage control to modify the setting under phase fault conditions.
RCD	Residual Current Device
CB	Circuit Breaker.
CT	Current Transformer.
DAR	Delayed Auto Reclose
IPCT	Interposing Current Transformer
VT	Voltage Transformer
VTS	Voltage Transformer Supervision
WTI	Winding Temperature Indicator.

3 General Requirements for Approvals and Testing

3.1 Product not to be Changed

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

3.2 Electricity North West Technical Approval

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

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

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

The supplier and product shall comply with all the relevant requirements of Electricity North West Limited document CP311.

The Tenderer shall complete the conformance declaration sheet in [Appendix C](#).

3.3 Quality Assurance

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

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

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

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

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

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

3.4 Formulation

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

3.5 Identification Markings

The Tenderer shall submit, with the Tender, details of markings which it is proposed to apply to the product or packaging to identify manufacturing batches or items. The forms and content of such markings shall be subject to the Approval of the Electricity North West Limited Protection Systems Manager and shall in all cases include the Electricity North West Limited approved description and commodity code number.

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

3.6 Minimum Life Expectancy

The minimum life expectancy of all products covered by this Specification is 45 years.

3.7 Product Conformity

Preference will be given to those Suppliers who can provide suitable product conformity certification to a recognised or specified standard, or an equivalent certification.

4 Requirements for Type and Routine Testing

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

4.1 Requirement for Type Tests at Suppliers Premises

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

These may or may not be destructive tests.

4.2 Requirement for Routine Tests at the Supplier's Premises

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

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

5 Technical Requirements

5.1 System of Supply

The panels are required in association with switchgear which is for use on Electricity North West Limited distribution system. The system is 3-phase, 50Hz.

5.2 Auxiliary Supplies, Indication and illumination

A 110V dc battery supply will be provided under a separate contract for closing and tripping of circuit breakers and for relay operation. Details of the scheme for obtaining supplies from this battery are given on Electricity North West Limited drawings accompanying this specification.

A 400/230V, 3-phase, 4-wire, 50Hz ac supply will be available.

Indication devices (i.e. panel lamps) will normally be operated from the substation main 110V dc supply and be of the LED type, not filament. Historically, indication devices were operated from a 110V ac supply, but under emergency conditions could be supplied from the 110V dc supply. If this is required, then details will be issued at time of tender and indication devices should be able to operate from both 110V ac and 110V dc.

Cubicles shall be provided with internal illumination such that all internal labelling, ferruling, and wiring can be readily identified. It is preferable to use long life low wattage 110V dc LED lighting in all new cubicles at existing and new build substations.

The lighting shall be controlled via a door mounted switch such that the light cannot be inadvertently left on. A central main light switch may also be provided to control a suit of panels this will be detailed on the supplied drawings if required.

The use of 'bulk-head' lighting is discouraged and lighting solutions such as low wattage 110V dc LED lighting is preferred. However, the use of LED lighting should not make the procurement of replacement LED lamps difficult and means of replacement should be easy to identify.

Historically, cubicle illumination lamps were operated from a 110V ac supply with more recent installations lamps were operated from a nominal 230V ac supply. This use of a 230V ac supply required that the wiring and connections were protected with an RCD located within the panel in addition to an isolation fuse / link, warning labels and shrouding for the 230V ac installation. The use of 110V ac or 230V ac is not prohibited for panels to be installed at sites where such an existing installation exists, to maintain a common site solution, but should be avoided for new sites or where multiple panels are to be replaced.

All cubicle illumination lamps shall be of the low energy, long life expectancy type.

5.3 Panel Type and Design

5.3.1 Free Standing / Floor Mounted

All free standing or floor mounted panels in this specification shall have the following dimensions:- 600mm deep x 600mm wide x 2250mm high (unless otherwise stated). The front sheet of the panel shall have an angled recess, the depth of which shall be approximately 60mm. Each relay or group of relays shall be mounted in accordance with international standard 483mm (19") rack mounting. (BS EN 60297-3). Blanking plates shall be provided as required and used to mount switches instruments and indicators etc (blanking plates may be panel or night coloured as clause 2.5.3). The panels shall be constructed of 2.5mm thick, enamelled mild steel.

5.3.2 The minimum height of the multicore cable gland plate from the floor shall be 225mm. In certain circumstances top entry multicore cable gland plates may be required in addition to or as an alternative to bottom entry. These will be specified on a job specific basis.

5.3.3 The label giving the circuit title shall be mounted on the cubicle itself and shall not project above the height of 2250mm. All labelling shall be in line with the requirements detailed within ES356 with the main panel label being as defined by drawing ES356/28, notably it shall be minimum 575mm x 100mm.

5.3.4 Labels shall also be fitted at the rear of each cubicle. The labels should be on the fixed portion of the cubicle and not on the doors.

5.3.5 All relays (unless otherwise stated) shall be mounted on the front of the panel in accordance with the front sheet layout drawings. They shall be not less than 450mm and not more than 1850mm above floor level. Equipment which is mounted inside on the side sheets of the cubicle shall not prevent access to the terminals or wires at the rear of the front panel. No equipment shall be mounted inside across the width of the cubicle.

5.3.6 Rear doors of a hinged lift off pattern shall be fitted. They shall be fitted with a hasp and staple for accommodating a padlock to suit the dimensions detailed in ES309 for switchgear padlocks. Doors with built in locks are not acceptable; a simple handle such that the door is reasonably close fitting and that vibration is prevented is all that is necessary.

5.3.7 It is sometimes required to erect the panels on an elevated floor (i.e. computer type flooring). In such instances it will be necessary for the Contractor to supply equipment for securing the panel(s) or suite of panels to the base floor below. The required arrangement is that the civil contractor will construct a Unistrut channel fixed to the base floor along the centre line of the panels. This should take the form of a channel section unit spanning the base of the cubicle(s) and clamping the panels to the elevated floor by means of a vertical threaded rod terminating in the Unistrut on the base floor. One such device shall be supplied for each end cubicle in a suite of panels plus one additional intermediate clamp for primary substations and three additional clamps for BSP substations. Each independently separate cubicle requires its own clamp.

5.3.8 Wall Mounted Panels

Wall mounted panels shall be designed in accordance with a general arrangement drawing as provided by Electricity North West Limited.

Wall mounted panels shall have a maximum gross weight of 75kg.

Wall mounted panels shall have top and bottom entry multicore cable gland plates as standard. Any change to these arrangements shall be agreed on a job specific basis with the Electricity North West Limited Grid and Primary design engineer.

5.4 Earthing

Floor mounted panels the Contractor shall supply an internal earth bar. The earth bar shall be approximately 25mm x 3mm hard drawn high conductivity copper. The earth bar shall facilitate the connection of additional panels in a suited arrangement without any external cable connections. The earth bar arrangement shall allow the connection of two 70mm² copper cable connections per suit or per panel for single panel installations.

Wall mounted panels the Contractor shall supply two M12 earth studs. These will be connected to an internal 25mm x 3mm earth bar and provide the external connection points for the wall panel to the substation earth bar.

Electricity North West Limited will be responsible for connecting the earth bar to the general substation earthing system at two points within each panel.

The Contractor shall connect all relay and instrument cases and/or frames to the internal earth bar. All opening doors shall be connected to the internal earth bar.

Certain panels require current transformer earthing facilities to be provided within the control/relay panels. In these cases, the CT wiring shall be earthed via a sliding bolted test link to facilitate testing, see section [5.6.11](#).

5.5 Padlocking Facilities

Padlocking facilities are required as follows with dimensions to suit switchgear padlocks as detailed in ES309:

- On the door(s) of all panels.
- On the CB control switch in the 'OFF' position (if fitted).
- On the control selector switch in either of the two positions (if fitted).
- On the bus zone cut-off switch in either of the two positions (if fitted).

5.6 Small Wiring

The small wiring shall generally conform to ENA TS 50-18, but shall take into account the following clauses.

- 5.6.1 All internal panel wiring shall have white colour insulation. All 110V dc wiring to be white. All 110V ac wiring to be Brown /Blue / Green-Yellow. All 230V/415V ac wiring to be Brown /Black /Grey /Blue / Green-Yellow.
- 5.6.2 All insulated wire shall be not less than 19/0.32mm (1.5mm²) and the design of the wiring cleats if used shall be such that only limited pressure can be transmitted to the wire. For CT/VT wiring the minimum size shall be 19/0.41mm (2.5mm²). Where specified by ENWL 110V ac and dc supplies wiring shall be suitably sized for the rating of the upstream protection device (typically 4mm² for a 32A fuse)

All pilot wiring shall be a minimum size of 1/0.8mm (0.5mm²) and comply with ES400C13. Pilot wiring shall be 15kV insulated and be run separate from all other protection and control wiring or double insulated where run together.

- 5.6.3 Each end of each wire or control cable connections shall be provided with a white interlocked ferrule bearing an engraved number in black corresponding to the diagram of connections. The use of printed ferrules may be considered but the system proposed must be approved by Electricity North West Limited prior to being used. The numbering of all connections shall correspond with the Electricity North West Limited standard schemes, which are based on ENA TS 50-19 – Standard Numbering for Small Wiring.
- 5.6.4 Flexible connections to swing panels shall be of equivalent cross sectional area to the secondary wiring. The cable shall be clamped at each end before making off to the terminal board. The clamping shall be such that when the panel is swung there shall be no localised bending in any part of the flex and no stresses shall be transmitted to the terminal connections. An alternative arrangement omitting terminal blocks on either side of the flexible connection may be approved provided the wires are bunched and run parallel to the hinge such that the individual wires are only subject to torsion.
- 5.6.5 Relay stems, studs, screw threads and connecting studs of the fuse holders, links, resistors and other apparatus should all be shrouded to minimise any inadvertent contact with live electrical components.
- 5.6.6 All stud or screw terminals without intervening barriers shall have clearance of not less than 25mm unless otherwise approved by the Electricity North West Limited .
- 5.6.7 Pinching screws shall not be used for small terminals. Terminals at a higher voltage than 125V ac or dc are to be segregated from other terminals and shrouded, the voltage being prominently marked on the shrouds and all diagrams. Each terminal block shall be provided with a cover securely fixed in position and made of transparent insulating material which will not support combustion. Terminal boards shall be labelled on the fixed portion to indicate the circuits involved.
- 5.6.8 Any 400, 3-phase ac supply shall be segregated and contained separate from all other wiring with suitable shrouding and warning labels.
- 5.6.9 All terminals shall be rail of a mounted type. Connections shall be of the screw clamp with spring loading unit type without isolation facilities. They shall meet the requirements as defined in ENA TS 50-18. Approved types that shall be used on all new equipment are Weidmüller WDU 10 SL/EN for current transformer circuitry and Weidmüller WDU 6 SL/EN for all other protection and control circuitry. Historically approved types that can be used for modification to existing panels are Weidmüller RSF3 for current transformer circuitry and Weidmüller RSF1 for all other protection and control circuitry. Alternative similar types to the above can be considered but must be approved in advance by Electricity North West Limited.
- 5.6.10 Terminals normally used for 48V dc (nominal) alarm circuits and SCADA, these terminals may be required to have an isolation facility. In such cases this shall comprise of a hinged lever having positive positioning in both open and closed positions. Connections shall be of the screw clamp with spring loading unit type and shall meet the requirements as defined in ENA TS 50-18. Approved types that shall be used are the Weidmüller WTR 4 SL/EN type (or similar approved by Electricity North West Limited). Historically the Weidmüller SAKR terminal was used, this type of terminal shall only be used in existing installations due to the poor mechanical strength of this type of terminal. The terminals shall have test points suitable for accommodating 2.3mm diameter test plugs.

- 5.6.11 When test links are specified (busbar protection test links, LDC CT test terminal links, etc) slide link disconnect terminals should be used. These terminals shall be of the Weidmüller SAKT1 or Weidmüller STL5 or equivalent type.
- 5.6.12 Terminals in which the screw compresses the bare conductor directly or through a washer or a 'U' plate are not acceptable. No conductor or termination shall clamp directly against the terminal insulation.
- 5.6.13 All terminals shall only offer the connection of 2 connections on each side of the terminal, terminals that offer multiple additional connections per side shall not be used.
- 5.6.14 Terminal rail shall be galvanised steel either TS32 or TS35 as appropriate to match terminals and comply with ENA TS 50-18, and/or BS EN 60715
- 5.6.15 All wiring of 1mm² (32/0.2mm) and larger shall be terminated with suitable insulated crimped terminations. For insertion clamp spring terminals a boot lace ferrule shall be used. For spring loaded terminals, hook type terminations shall be used. For plain screw clamp terminals, blade type terminations shall be used.
- 5.6.16 The busbar protection test CTs test terminals should be the panel mounted insulated type, with a 10A rating. They should accept a continental 4mm plug.
- 5.6.17 All buswires for panels in [Appendix B](#) shall be made available at both the buswire terminal block and main terminal board.
- 5.6.18 No terminals or other components shall be fitted on the bottom plate of floor mounted panels.

5.7 Fuses and Links

All fuses bases or carriers shall be 20A Red Spot over the available current range. Fuse links shall have appropriate ratings and certification of breaking capacity for the system on which they are being used, in accordance with BS EN 60269-1 (or equivalent).

Carriers and bases shall be coloured in accordance with the following code:

- 6A (up to and including) Black (See note below)

(Note: fuse carriers for fuses up to and including 6A shall be marked with a coloured tape to identify the rating of the fuse)

- 16A Sea Green No 217 in BS 381c
- Over 16A Black
- Link White

All fuses and links shall be mounted on the front of the panel (unless otherwise stated) and shall be labelled in accordance with Electricity North West Limited standards. The preferred method is by means of a label mounted above the fuse carrier. Other methods must be approved by Electricity North West Limited.

4mm safety connecting plugs and links ("Handbag" links) shall be used where specified. Unless specified otherwise these will be the Multi Contact type XVB-4/19.

Relay power supply links and fuses shall have shrouds and bar fitted where specified. A warning label shall be fitted across the relay power supply links and fuses where specified. The label shall state "Warning removing the relay power supply FS or LK will disable the protection and control relays".

All pilot circuits shall be fitted with 15kV pilot isolation links, type PPT35.

5.8 Indications and Alarms

Control panels shall where specified be provided with indications as follows:

- Green indicator to display circuit breaker open.
- Red indicator to display circuit breaker closed.

The indication shall be placed near to the CB control switch, with green to the left and red to the right as viewed from the front.

Alarms may be grouped on a relay in a wall mounted or freestanding panel as specified by Electricity North West Limited.

5.9 Telecontrol

Where telecontrol equipment is used it will still be necessary for occasional operation from within the substation and the equipment therefore shall be designed accordingly. A Selector type switch () shall be provided to permit an operator to select operation either from within the substation (Local) or via SCADA (telecontrol).

There are two designs of interposing relay required to be operated from the Electricity North West Limited telecontrol outstations. These are described here as either monostable or bi-stable. The monostable type is used for circuit breaker opening and closing and is required to have heavy magnetic blowout contacts to interrupt the dc tripping or closing current in the event of circuit breaker failure to trip or close.

The manufacturers identified below have produced appropriate 50V dc relays with 500 ohm operating (and reset) coils. These relays are "specials" and reference to "Electricity North West Limited requirements" should be made with any order.

Monostable interposing telecontrol relays shall be either:

- For internal mounting - GE Prima PRS11U03TH (preferred) and PSF3 base or Clifford and Snell type D2600 ref: D2600/24/FP1/50V dc (code 6S5499).
- Where practicable the relays shall have a flag indication and test push button feature.

Bi-stable interposing telecontrol relays shall be either:

- For internal mounting - GE Prima PRH11U03TH (preferred) and PSF3 base or Clifford and Snell type D2600 ref: D2600/LE/FP9/CCTA/50V dc/500 ohm (code 6L3182).
- Where practicable the relays shall have a flag indication and test/reset push button feature.

Interposing VTs and CTs shall be in accordance with Electricity North West Limited Electricity Specification ES336 (tap position interposing unit is constructed using two interposing voltage transformers). Telecontrol transducers shall be in accordance with Electricity North West Limited Electricity Specification ES335. The interposing CTs and VTs and transducers will be as specified on the appropriate Electricity North West design drawings.

5.10 Circuit Breaker (CB) Control Switches

Where specified CB control switches shall be arranged to operate in a clockwise direction whilst closing the circuit breakers and in the opposite direction when opening them. The control switches shall be returned to the off position by a spring. Approved means are to be provided for padlocking the control switch in the off position. The control switch handles shall comply with ENA TS 50-18.

5.11 Instruments

All indicating instruments shall comply with BS EN 60051, Grade 1, and shall be of an Approved design.

All meters shall be of a deadbeat design having a damped needle that stops without oscillation and be capable of carrying their full load currents continuously without undue heating. Scales shall be approved.

All instruments shall be of the flush mounting pattern with bright black enamelled bezels.

All indicating instruments shall be 96mm moving iron pattern with square bezel. The scale length shall be as near as possible to 150mm.

Ammeters shall be Class Index 5.0. The burden shall not exceed 3VA at the current corresponding to full scale deflection.

The scales shall be open at the lower end. The scaling's shall be such that the first 25% of scale length covers not more than 27½% of the full scale reading and 90% of the scale length shall coincide with not less than 70% of the full-scale reading.

5.12 Relays

All protection relays shall be of the modular type where practicable unless otherwise specified.

The Tenderer shall ensure that all protection relays to be supplied are acceptable to Electricity North West Limited or contained within EPD307 – Approved Equipment for use on the Electricity North West Limited network. Particular attention is drawn to the use of digital (numeric) relays using associated software driven settings programs. The currently approved relays are detailed within EPD307. If other manufacturer's relays are offered (or new relays from existing manufacturers), the tenderer shall propose the means by which he will equip and train Electricity North West Limited staff in the use of the relays and associated software. Unless agreed with Electricity North West Limited, it shall not be assumed that digital relays other than those detailed in EPD307 are acceptable.

The Tenderer shall always refer to the latest standard drawings to ensure compliance with the applications. Where a tenderer is proposing the use of alternative relays this should be discussed and agreed with Electricity North West Limited at the earliest opportunity.

Electricity North West Limited reserve the right to nominate the type and manufacturer of any relay.

It shall not be possible to operate any relay by hand without opening the case.

All relays shall be supplied equipped with identification labels in accordance with standard drawings.

Relays of the hand reset type shall be capable of being reset without the necessity of opening the case.

Loose components including but not limited to resistors and diodes shall be housed in a fixed enclosure of a type to be agreed with Electricity North West Limited.

All relays shall be supplied with sufficient input dropping resistors or other necessary equipment for all binary inputs to facilitate the use of all relay input functions even if none are utilised in the current scheme.

5.13 AC and DC Supplies

For the purposes of this Specification a 110V dc (nominal) battery and a 400-230 volt 3 phase ac supply may be assumed as standard.

5.14 Drawings and Diagrams

All circuit diagrams, wiring diagrams and general arrangement drawings shall be owned by and provided to Electricity North West Limited. A copy of all drawings and diagrams shall be submitted to Electricity North West Limited as necessary for Approval.

Where Electricity North West Limited provide schematic (or circuit) diagrams only the Tenderer shall generate the necessary wiring and general arrangement diagrams. These shall be submitted to Electricity North West Limited for Approval before manufacture of any panels.

Drawings shall be monochrome black line on white paper, at least ISO A1 and not exceeding ISO A0 in size, with a clear margin on each edge of at least 25mm.

Multipage drawing booklets are not acceptable.

All drawings shall be submitted for approval to Electricity North West Limited before manufacture of any panels. Drawings can be submitted in electronic format either PDF or AutoCAD 2019 DWG format, for large collections of drawings Electricity North West Limited reserves the right to request them to be provided in hardcopy along with digital copy. Electronic transmittal can be via E-Mail if appropriate for the file size or via external file transfer.

All drawing shall carry the following information within the drawing title block, the name of the site, the Electricity North West Limited drawing number, the manufacture drawing reference, date and number of drawing revision.

All drawings shall be numbered according to a logical scheme.

As manufactured drawings shall be provided to Electricity North West Limited following any Factory Acceptance Testing and within a maximum of 6 weeks following manufacture, all as manufactured drawings shall be submitted in AutoCAD 2019 electronic format.

6 Documents Referenced

DOCUMENTS REFERENCED	
Control of Substances Hazardous to Health Regulations 2002	
Health and Safety Manual Handling Operation Regulations 1992	
Health and Safety at Work Act 1974	
BS EN 60998-1:2004	Connecting devices for low voltage circuits for household and similar purposes.
BS EN 60255-1:2010	Measuring Relays and Protection Equipment
BS EN 60051-1: 1999	Direct acting indicating analogue electrical measuring instruments and their accessories
BS EN 60297 -3	Dimensions of mechanical structures of the 482.6mm (19in) series
BS EN 60715:2001, IEC 60715:1981+A1:1995	Dimensions of low-voltage switchgear and controlgear. Standardized mounting on rails for mechanical support of electrical devices in switchgear and controlgear installations
BS HD 60269-1: 2009, BS 88-1: 2007	Low voltage fuses. General Requirements
BS EN ISO 14001: 2004	Environmental Management Systems
BS381C: 1996	Specification for colours for identification, coding and special purposes
BS ISO 9000-2: 1997	Quality Management and Quality Assurance Standards
ENA TS 48-4	DC Relays associated with a Tripping Function in Protection Systems

ENA TS 50-18	Design and Application of Ancillary Electrical Equipment
ENA Engineering Recommendation S15	Standard Schematic Diagrams
ENA TS 50-19-1	Standard Numbering for Small Wiring (for switchgear and transformers together with their associated relay panels).
CP311	Equipment Approval Policy and Process
ES309	Locks for Substations and Associated Plant
ES335	Telecontrol Watt and VAr Transducers
ES336	Interposing Transformers for Telecontrol Current and Voltage Measurements
ES356	Notices and Nameplates
ES400C13	Multicore & Multipair Auxiliary Cables
EPD307	Equipment Approved for use on Electricity North West Network

7 Keywords

Relay; Control; Protection; Panel; Auxiliary; Wiring

Appendix A – Current Drawing List

DRAWING NO	REV	PANEL REF	CONTROL AND RELAY PANELS
900480-00035 900480-00036 900480-00038		AVC31	11/6.6kV SuperTapp SG Wall Mounted Panel (Non DNP3 Switchgear)
900480-00040 900480-00041 900480-00043		AVC32	11/6.6kV SuperTapp SG Wall Mounted Panel (DNP3 Switchgear)
900440-00041 (AC) 900440-00042 (DC) 900440-00043 (DC)		RZ33	33kV Busbar Protection Panel 2/3 Section Board
900219-00020 900219-00021 900219-00022 900219-00024		GTHV	Grid Transformer HV Protection Panel with Line Protection (GE Relays)
900219-00020 900219-00021 900219-00022 900219-00023		GTLV	Grid Transformer LV Protection Panel with Delayed Auto Reclosing (GE Relays)
900219-00013 900219-00014 900219-00015		INT132-ABB1	132kV VF Intertripping ABB (Addition to GTHV Panel)
900219-00010 900219-00011 900219-00012		INT132-RFL1	132kV VF Intertripping RFL (Addition to GTHV Panel)
		INT132-GCM051	132kV DC Intertripping (Addition to GTHV Panel)

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Appendix B – Current Protection and Control Relay Panels

B1 AVC31 – NON DNP3 SWITCHGEAR

AVC31 - 11/6.6KV SUPERTAPP SG TAP CHANGE WALL MOUNTED CONTROL PANEL	MODEL NO
The following equipment shall be mounted in the 500Hx700Wx375Dmm wall mounted enclosure panel in accordance with the appropriate panel layout drawing.	
Set of labels (main and other) to Electricity North West Limited Electricity Specification ES356	
Fundamentals SuperTAPP SG Tap Change Control Relay.	FP1034-AG00000PDS-L05-3A
Test Block Type MMLG02	GE MMLG02-R1-AA-0001
Fundamentals Interposing CT's for SuperTAPP SG Relay	FP1030-CT1000-1-S01 1000:1
Ethernet socket (DIN rail mounted)	Klippon IE-XM-RJ45/RJ45
Nortech Envoy Data Transmission Unit, Hardware Revision D	Envoy EN10-0311
Nortech Antenna for envoy unit	ACC-1240
AVC Resistor Block	Entrelec M 4/6.DE1.D
RS20P GE Red Spot fuses and links, small wiring, terminal boards, etc as per Electricity North West standard diagrams (see Appendix A)	
Multicore terminations – gland, gland plates, terminal boards, earth studs	

B2 AVC32 – DNP3 SWITCHGEAR

AVC32 - 11/6.6KV SUPERTAPP SG TAP CHANGE WALL MOUNTED CONTROL PANEL	MODEL NO
The following equipment shall be mounted in the 500Hx700Wx375Dmm wall mounted enclosure panel in accordance with the appropriate panel layout drawing.	
Set of labels (main and other) to Electricity North West Limited Electricity Specification ES356	
Fundamentals SuperTAPP SG Tap Change Control Relay.	FP1034-AG00000PDS-L05-3A
Test Block Type MMLG02	GE MMLG02-R1-AA-0001
Fundamentals Interposing CT's for SuperTAPP SG Relay	FP1030-CT1000-1-S01 1000:1
Ethernet socket (DIN rail mounted)	Klippon IE-XM-RJ45/RJ45
Nortech Envoy Data Transmission Unit, Hardware Revision D	Envoy EN10-0311
Nortech Antenna for envoy unit	ACC-1240
AVC Resistor Block	Entelec M 4/6.DE1.D
RS20P GE Red Spot fuses and links, small wiring, terminal boards, etc as per Electricity North West standard diagrams (see Appendix A)	
Multicore terminations – gland, gland plates, terminal boards, earth studs	

B3 RZ33

RZ33 – BUSBAR PROTECTION PANEL 2/3 SECTION BOARD	MODEL NO
The following equipment shall be mounted in the 2200H x 800W x 800Dmm free standing 19" rack front access cubicle in accordance with the appropriate layout drawing.	
3 off Main Zone Discriminating relays with single phase metrosil	MFAC14-S1-A-A-0001
3 off Main Zone CT supervision relay	MVTP11-T1-C-B-0751
4 off Hand reset tripping relay with 20 standard output contacts	MVAJ203-T-A-08-04
1 off Check Zone Discriminating relay	MFAC14-S1-A-A-0001
1 off Check Zone CT Supervision relay	MVTP11-T1-C-B-0751
2 off Busbar Protection Supervision Supply Voltage Fail Relay	MVAX12-R1-C-B-0756
2 off LED Indication Lamp	
Busbar protection cut off switch	Craig & Derricott MQ42/2/NC/SMLHC
4 off Setting Resistor	Pentagon PE 180 2K K ADJ
RS20P GE Red Spot fuses and links, small wiring, terminal boards, etc as per Electricity North West Limited standard diagrams (see Appendix A)	
Multicore terminations – gland, gland plates, terminal boards, earth studs	

B4 GT HV

GTHV – GRID TRANSFORMER HV PROTECTION AND LINE PROTECTION (GE RELAYS)	MODEL NO
<p>The following equipment shall be mounted in the floor standing relay panel with a standard 600 x 600mm footprint with rear access door and 19” rack format fascia in accordance with the appropriate layout drawing.</p>	
Grid Transformer Differential Protection Relay (Biased Differential, flush mounted)	GE Micom P642 - P642-811-A4-M0-04-0J
2-Stage Overcurrent Relay with Trip Relay Reset Or 2-Stage Overcurrent Relay, Trip Relay Reset and GT Alarms	GE Micom P14N - P14N-B11-A5-B0-50-0A Or GE Micom P145 - P145-811-C4-M0-46-0J
HV Restricted Earth Fault Relay	GE MFAC14-S1-AA-0001
Grid Transformer HV Tripping Relay	GE MVAJ-105-RA-0802-A
4 off Test Block (2xDiff, LP, HVOC), Size E2 case, flush mounted	GE MMLG01-R1-AA-9002
Line Protection Relay	GE P541-814-A4-M0-30-0J
Line Protection Tripping Relay	GE MVAJ-105-RA-0802-A
Inter-trip Receive Trip Relay	GE MVAJ105-RA-0802-A
Inter-trip Follower Relay	GE MVAA11-R1-BA-0783-C
Inter-trip Test Switch Module	GE MMLZ20-03 – UU Special
Inter-trip Supply Supervision Relay	GE MVAX12-R1-CB-0756-A
Inter-trip isolating links	Multicontact XVB-4/19 & SLB4G
Setting Resistor for HV REF	Pentagon PE180 1K K ADJ
132kV Disconnecter Open – Telecontrol Interposing Relay	GE Prima PRS11U03TH relay plus PSF3 base
132kV Disconnecter Close – Telecontrol Interposing Relay	GE Prima PRS11U03TH relay plus PSF3 base
RS20P GE Red Spot fuses and links, small wiring, terminal boards, etc as per Electricity North West Limited standard diagrams (see Appendix A)	

B5 GT LV

GTLV – GRID TRANSFORMER LV PROTECTION WITH DELAYED AUTO RECLOSE (GE RELAYS)	MODEL NO
The following equipment shall be mounted in the floor standing relay panel with a standard 600 x 600mm footprint with rear access door and 19” rack format fascia in accordance with the appropriate layout drawing.	
2-Stage Standby Earth Fault (SBEF), Neutral Current Alarm Relay	GE Micom P14N - P14N-B11-A4-B0-50-0A
LV Restricted Earth Fault Relay (LVREF)	GE MFAC14-S1-AA-0001
Low Frequency Relay (LFR)	GE Micom P94V – P94V-B11-A4-B0-50-0A
Directional Overcurrent Relay (DOC) and Delayed Auto Reclose (DAR) Relay	GE Micom P145 - P145-811-C4-M0-46-0J
Directional Overcurrent Relay Tripping Relay	GE MVAJ105-RA-0802-A
Low Frequency Trip Relay	GE MVAJ101-RA-0802-A
Grid Trip Relay	GE MVAJ101-RA-0802-A
LV Trip Relay	GE MVAJ101-RA-0802-A
Busbar Protection Trip Relay	GE MVAJ101-RA-0802-A
Protection Supply Supervision Relay	GE MVAX12-R1-CB-0756-A
Trip Circuit Supervision Relay	GE MVAX31-S1-DE-0754-A
3 off Test Block (SBEF, DOC, LF), Size E2 case, flush mounted	GE MMLG01-R1-AA-9002
DAR IN / NORMAL / OUT Selector Switch 3-Position (spring return to centre), 2-pole switch with locking facilities.	Craig & Derricott - MD23/SR/NC/SALHC
DAR LOCAL / REMOTE Selector Switch 2-Position, 4-pole switch with locking facilities	Craig & Derricott - MQ42/2/NC/SMLHC
DAR IN – Telecontrol Interposing Relay	GE Prima PRS11U03TH relay plus PSF3 base
DAR OUT – Telecontrol Interposing Relay	GE Prima PRS11U03TH relay plus PSF3 base
Alarm Reset Push Button	
Setting Resistor for LV REF	Pentagon PE180 1K K ADJ
RS20P GE Red Spot fuses and links, small wiring, terminal boards, etc as per Electricity North West Limited standard diagrams (see Appendix A)	

B6 INT132-ABB

132kV Inter-tripping Panel ABB NSD Relays	MODEL NO
<p>The following equipment shall be mounted in the floor standing relay panel with a standard 600 x 600mm footprint with rear access door and 19" rack format fascia in accordance with the appropriate layout drawing.</p>	
<p>The panel shall be designed to accommodate a minimum of 2 complete inter-tripping relays</p>	
<p>Intertripping Equipment Dual channel Digital over copper pilot wires or fibre optic (to be specified on per job basis)</p>	<p>ABB NSD570 NSD570-SP-G3LR-3C794-110-25</p>
<p>Intertripping Supply Supervision</p>	<p>GE MVAX12-R1-CB-0756-A</p>
<p>RS20P GE Red Spot fuses and links, small wiring, terminal boards, etc as per Electricity North West Limited standard diagrams (see Appendix A)</p>	<p>GE Red Spot</p>
<p>Multicore terminations – gland, gland plates, terminal boards, earth studs</p>	

B7 INT132-RFL

132kV Inter-tripping Panel RFL 9745 Relays	MODEL NO
<p>The following equipment shall be mounted in the floor standing relay panel with a standard 600 x 600mm footprint with rear access door and 19" rack format fascia in accordance with the appropriate layout drawing.</p>	
<p>The panel shall be designed to accommodate a minimum of 2 complete inter-tripping relays</p>	
<p>Intertripping Equipment Dual channel Digital over copper pilot wires or fibre optic (to be specified on per job basis)</p>	<p>RFL9745E GD2A0E1-00-Y0900 EDS_TTS_1D</p>
<p>Intertripping Supply Supervision</p>	<p>GE MVAX12-R1-CB-0756-A</p>
<p>RS20P GE Red Spot fuses and links, small wiring, terminal boards, etc as per Electricity North West Limited standard diagrams (see Appendix A)</p>	<p>GE Red Spot</p>
<p>Multicore terminations – gland, gland plates, terminal boards, earth studs</p>	

B8 INT132-GCM05

132kV Inter-tripping Panel GCM05 Relays	MODEL NO
<p>The following equipment shall be mounted in the floor standing relay panel with a standard 600 x 600mm footprint with rear access door and 19" rack format fascia in accordance with the appropriate layout drawing.</p>	
<p>The panel shall be designed to accommodate a minimum of 2 complete inter-tripping relays</p>	
<p>Intertripping Equipment Dual channel Digital over copper pilot wires or fibre optic (to be specified on per job basis)</p>	<p>Schneider / Gayrad GCM05 GCM05XX0751A - 4 Normally Open Intertrip receive contacts</p>
<p>Intertripping Supply Supervision</p>	<p>GE MVAX12-R1-CB-0756-A</p>
<p>RS20P GE Red Spot fuses and links, small wiring, terminal boards, etc as per Electricity North West Limited standard diagrams (see Appendix A)</p>	<p>GE Red Spot</p>
<p>Multicore terminations – gland, gland plates, terminal boards, earth studs</p>	

Appendix C – Conformance Declaration

SECTION-BY-SECTION CONFORMANCE WITH SPECIFICATION

The Tenderer shall declare conformance or otherwise for each product/service or range of products/services, section-by-section, using the following Conformance Declaration Codes.

Conformance Declaration Codes:

N/A =	Clause is not applicable/appropriate to the product/service.
C1 =	The product/service conforms fully with the requirements of this clause.
C2 =	The product/service conforms partially with the requirements of this clause.
C3 =	The product/service does not conform to the requirements of this clause.
C4 =	The product/service does not currently conform to the requirements of this clause, but the manufacturer proposes to modify and test the product in order to conform.

Manufacturer:

Product/Service Description:

Product/Service Reference:

Name:

Company:

Signature:

SECTION-BY-SECTION CONFORMANCE

Section	Section Topic	Conformance Declaration Code	Remarks * (must be completed if code is not C1)
3.1	Product not to be Changed		
3.2	Electricity North West Limited Technical Approval		
3.3	Quality Assurance		
3.4	Formulation		
3.5	Identification Markings		
3.6	Minimum Life Expectancy		
3.7	Product Conformity		
4.1	Requirements for Type Tests at the Supplier's Premises		
4.2	Requirement for Routine Tests at the Supplier's Premises		
5.1	System of Supply		
5.2	Auxiliary Supplies, Indication and Illumination		
5.3	Panel Type and Design		
5.4	Earthing		
5.5	Padlocking Facilities		
5.6	Small Wiring		
5.7	Fuses and Links		
5.8	Indications and Alarms		

5.9	Telecontrol		
5.10	Circuit Breaker Control Switches		
5.11	Instruments		
5.12	Relays		
5.13	AC and DC Supplies		
5.14	Drawings and Diagrams		
Appendix A	Current Drawing List		
Appendix B	Current Protection and Control Relay Panels		
B1	AVC31 – Non-DNP3 Switchgear		
B2	AVC32 – DNP3 Switchgear		
B3	RZ33		
B4	GT HV		
B5	GT LV		
B6	INT132-ABB		
B7	INT132-RFL		
B8	INT132-GCM05		

Additional Notes: