



Electricity Specification 302

Issue 1 December 2011

Packaged Housings for 6.6kV, 11kV and 33kV Switchgear

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Approved for issue by the Technical Policy Panel

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PACKAGED SWITCHGEAR HOUSINGS

1. INTRODUCTION

This specification covers pre-fabricated switch-housings which have the switchgear, ancillary equipment and apparatus pre-installed at the factory. The switchgear, equipment and apparatus shall be type approved for use on the Electricity North West Limited (Electricity North West) network. The apparatus and equipment shall be installed and tested such that the housing can be installed on site, connected and commissioned with a minimum of on site project duration. If housings are offered that are not of steel construction then their performance and durability shall be equivalent.

2. SCOPE

This Specification covers the general design and construction of pre-fabricated switchgear housings for use on the 6.6kV, 11kV or 33kV network of Electricity North West. This includes the installation of the switchgear and associated apparatus, but not the Specification, or type Approval, of the switchgear and associated apparatus. The supply of the housing, the supply of the switchgear and the installation of the switchgear into the housing with final delivery, installation and commissioning may be undertaken by one or more Supplier/Contractor.

3. DEFINITIONS

Approval:	Sanction by the Electricity North West Plant Policy Manager that specified criteria have been satisfied.
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.
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 Plant Policy Manager, and the legal representatives, successors and assigns of such person.
Supplier:	Any person or person's firm or company who supply goods to Electricity North West or Electricity North West contractor.
Tender:	An offer in writing to execute work or supply goods at a fixed price.
Tenderer:	The person or person's firm or company, including personal representatives, successors and permitted assigns, invited by Electricity North West to submit a Tender.
Words:	Words importing persons shall include firms and corporations; words importing the singular only, also include the plural, and vice versa where the context requires.
Work:	All materials, labour and actions required to be provided or performed by the Contractor under the Contract.
Writing:	Any manuscript, typewritten or printed statement under seal or hand as the case may be.

4. GENERAL REQUIREMENTS FOR APPROVALS

4.1 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 Plant Policy Manager, and receipt of a written agreement to the proposed change from the Electricity North West Plant Policy Manager.

4.2 Electricity North West Technical Approval

- 4.2.1 The Tenderer shall submit, with this Tender, proposals for any testing which will demonstrate, to the satisfaction of the Electricity North West Plant Policy Manager, compliance with this Specification. Such tests shall be carried out without expense to Electricity North West.
- 4.2.2 Alternatively, the Tenderer may submit technical reports and other data that he considers will demonstrate, to the satisfaction of the Electricity North West Plant Policy Manager, compliance with this Specification. Such reports and data shall be sufficient to demonstrate that the product is of sound structural design and will be fit for purpose. Acceptance of this evidence shall be at the discretion of the Electricity North West Plant Policy Manager but will not be unreasonably withheld.
- 4.2.3 Approval shall be 'factory specific' and is not transferable to another factory without the written Approval of the Electricity North West Plant Policy Manager.
- 4.2.4 Approval shall be in two parts, firstly for the housing and secondly for the installation of the switchgear and ancillary equipment and apparatus.
- 4.2.5 The supplier and product shall comply with all the relevant requirements of Electricity North West documents Electricity Policy Document (EPD) 311 and Code of Practice (CP) 311.

4.3 Quality Assurance

- 4.3.1 The Tenderer shall confirm whether or not Approval is held in accordance with a Quality Assurance Scheme accredited under ISO 9000. If not, he shall submit a statement of the quality assurance procedures employed to control the quality of the product, including the performance of Suppliers and Sub-Contractors.
- 4.3.2 The right is reserved for the Electricity North West Plant Policy Manager to require, from time to time, the repeat of such tests as he may deem to be reasonably necessary to demonstrate continued compliance with the Specification.
- 4.3.3 The Tenderer shall submit, with his Tender, a list of tests and inspections which are carried out on the product prior to despatch which shall demonstrate, to the satisfaction of the Electricity North West Plant Policy Manager, fitness for installation and service.
- 4.3.4 The Tenderer shall provide free of charge to Electricity North West such samples as may, in the opinion of the Electricity North West Plant Policy Manager, be reasonably required for inspection and/or retention as quality control samples. The Electricity North West Plant Policy Manager will confirm the requirement for samples at the time of Tendering.

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

4.3.6 The Tenderer shall submit, with his Tender, such details of product packaging disposal, as will enable Electricity North West to comply with the requirements of BS EN ISO 14001: 2004 – Environmental Management Systems.

4.4 Formulation

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

4.5 Identification Markings

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

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

4.6 Minimum Life Expectancy

The minimum life expectancy of all products covered by this specification is 40 years.

4.7 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.

The Tenderer shall complete the conformance declaration sheet in Appendix A.

5. HOUSING TECHNICAL REQUIREMENTS

5.1 Housing Size

- 5.1.1 The overall size and height of the housing can vary depending on equipment and location.
- 5.1.2 Typical 6.6kV/11kV switch-houses will contain:-
- Type A: Two incomer units, a bus-section unit and associated bus riser panel(s), six outgoing feeder units and provision for adding one later unit on each end of the switchboard.
- Type B: Two incomer units a bus-section unit and associated bus riser panel(s), ten outgoing feeder units and provision for adding one later unit on each end of the switchboard.
- 5.1.3 Typical 33kV switch-houses will contain:-
- Type A: Two incomer units, a bus-section unit and associated bus riser panel(s), two outgoing transformer units and provision for adding one later unit on each end of the switchboard.
- Type B: Four incomer units a bus-section unit and associated bus riser panel(s), two outgoing transformer units and provision for adding one later unit on each end of the switchboard.
- Type C: Two incomer units and one outgoing transformer unit.
- 5.1.4 The exact amount and type of ancillary apparatus may vary. This shall be specified at the time of Tender. See section 7. A typical 6.6/11kV housing requires space for 2 marshalling boxes (see section 7.5), a 110 volt battery and charger, a 48 volt battery and charger, a telecontrol outstation, a wall mounted alarm panel and 2 wall mounted tap change control panels. A typical 33kV housing requires space for 2 marshalling boxes (see section 7.5), a 110 volt battery and charger, a 48 volt battery and charger, a telecontrol outstation, and a wall mounted alarm panel.
- 5.1.5 The position and spacing of switchgear to the walls and ceiling shall be in accordance with the switchgear manufacturer's specification.
- 5.1.6 There shall be space for a desk, filing cabinet and two chairs. Storage space is required for switchgear tools and test devices as supplied by the manufacturer and a step ladder suitable for accessing the top of the switchgear and highest equipment on the walls and ceiling.
- 5.1.7 The Tenderer shall offer an option to fit a dividing wall and door within the housing. Such dividing wall shall be to provide an ante-room at the main entrance door prior to entering the switchroom. The ante-room may contain items of the ancillary apparatus such as the telecontrol cabinet, battery housing, alarm panel and lvac supplies panel. Alternatively the Tenderer shall offer an option for the main entrance to access the switchroom via a porch.

5.2 Housing Main Material

- 5.2.1 The standard unit shall have a material and finish suitable for at least a 20 year periodicity until it needs re-coating. This is a high durability in a typical environmental category of at least C3 urban and industrial atmospheres with moderate sulphur dioxide and production areas with high humidity as described in ISO 12944. All external components, fixtures, fittings and attachments shall be to the same environmental category as the main housing. The Tenderer shall specify the necessary maintenance schedule to meet this and the minimum life expectancy as in section 4.6.
- 5.2.2 A higher specification unit shall also be offered which is suitable for use in a more aggressive corrosion environment which is C4 industrial and coastal and chemical processing plants as described in ISO 12944. This shall also be of high durability. The Tenderer shall specify the necessary maintenance schedule to meet this and the minimum life expectancy as in section 4.6.
- 5.2.3 The finish colour may vary from site to site to meet local requirements. Unless otherwise specified in Appendix C, this shall be Dark Admiralty Grey to BS 4800.
- 5.2.4 The Tenderer shall offer a choice of optional additional surface finishes or cladding which will increase the scope for meeting local planning requirements.
- 5.2.5 The Tenderer may offer enhanced paint finishes to higher standards of durability and environmental category for consideration by Electricity North West.
- 5.2.6 The structural design shall be such that there is no significant deflection or deformity when lifted with the apparatus installed. The Supplier shall provide copies of the structural calculations to demonstrate this.
- 5.2.7 The housing shall be designed and constructed to achieve the following minimum insulation levels.
- Roof - 0.13 W/m²K
- Walls - 0.27 W/m²K
- Floor - 0.6 W/m²K
- 5.2.8 The external structure shall have at least one hour fire resistance.

5.3 Requirement for Internal Arc

All prefabricated housings shall be designed and constructed to withstand the effects of an internal arc within a sealed chamber inside the housing.

For 6.6kV switchboards the arc energy shall be 250MVA (21.9kA at 6.6kV) for 1 second. For 11kV switchboards the arc energy shall be 250MVA (13.1kA at 11kV) for 1 second. For 33kV switchboards the arc energy shall be 1000MVA (17.5kA at 33kV) for 1 second.

The criteria for withstand shall include:

- (a) Doors to remain closed and latched.
- (b) Minimum projection of flame through door and joint gaps.
- (c) No breakage of wall or roof material or any other joints.
- (d) Pressure relief vents may be utilised.
- (e) Deflection of any ejected flame away from persons directly adjacent to building.

This may be achieved either by test at an accredited short circuit test station, or by a synthetic fuel/air explosion. The method detailed in the BRE confidential report TCR 20/97 is approved. The judgement on the acceptability of the housing design as having passed the explosion test will be based on:

- (a) A high speed video to the requirements of BRE test report TCR 20/97 of a test at an accredited short circuit test station, or:-
- (b) The written report of the accepted testing authority, or:-
- (c) Design calculation.

5.4 Roof

The roof shall be of pitched construction. It shall be designed such that water is shed away from the doors and arc relief vents.

5.5 Doors and Fittings

- 5.5.1 External doors shall open outwards. Any internal door shall open towards the nearest means of egress.
- 5.5.2 External doors shall have a cylinder mortice lock capable of taking the standard Yale substation lock barrel. Standard substation lock barrels shall be fitted immediately on installation on site. Lock barrels shall be provided by Electricity North West. Doors shall have a security rating of Security Equipment Assessment Panel (SEAP) level 2. Alternative security certification bodies such as the Loss Prevention Certification Board – Loss Prevention Standard (LPS) 1175 Level 3 or higher may be acceptable subject to the Tenderer clearly demonstrating a satisfactory service history over a significant period of time, subject to the approval of the Electricity North West Plant Policy Manager.
- 5.5.3 External doors shall have one hour fire resistance.
- 5.5.4 All external doors shall have panic bar operation from the inside.

- 5.5.5 Doors shall be sized such that additional units of switchgear can be installed.
- 5.5.6 Doors shall have an earth bond strap fitted to each leaf.
- 5.5.7 At least one emergency exit door shall be included in the housing. It is preferred that an emergency door is sized for bringing in additional switchgear units rather than the normal access door.
- 5.5.8 The main entrance door shall be positioned, on a site specific basis, such that it is not facing the prevailing winds.

5.6 Internal Environmental Control

- 5.6.1 The air shall be maintained at a combination of temperature and humidity that will ensure that equipment is maintained with a suitable operating range of temperature without risk of condensation, damage or deterioration. Heating, ventilation and air conditioning equipment (HVAC) shall be installed to provide these conditions.

HVAC controls shall be set to provide the following operational conditions:-

- (a) Normal operating range shall be between 10 and 15°C. For higher external ambient temperatures in excess of 25°C then the maximum internal temperature shall be no more than 25°C.
 - (b) Relative Humidity (RH) shall not exceed 60%.
 - (c) Control and alarm thermostats shall be nominally mounted at 1.7 metres height on the back wall at the rear of the switchgear.
 - (d) There shall be four air changes per day.
- 5.6.2 HVAC equipment and ventilation shall be protected against vandalism, vermin and ingress of moisture. Such protection shall be approved by Electricity North West.
 - 5.6.3 An alarm thermostat shall be mounted on the wall at the rear of the switchgear at 1.7 metres height. This shall nominally be set at 7°C.
 - 5.6.4 Two alarm humidistats operating in parallel shall be fitted on the wall at the rear of the switchgear. One shall be level with the top of the switchgear and one shall be mounted no more than 100mm above the floor. These shall be set at 70%RH
 - 5.6.5 A heating manual override timer switch, with three time period settings, shall be fitted adjacent to the main door for staff to use. These settings shall normally be 30 minutes, 1 hour and 2 hours.
 - 5.6.6 The positioning of HVAC equipment shall be approved by Electricity North West in the final layout. Control and alarm thermostats and humidistats shall be positioned such that they are not adversely affected by the outputs of the HVAC equipment.
 - 5.6.7 The installation shall comply with BS 7671 Requirements for Electrical Installations, IEE Wiring Regulations, Seventeenth Edition.

- 5.6.8 The Tenderer shall provide details of the installation design and calculations to demonstrate compliance with the environmental control requirements.

5.7 Earthing

- 5.7.1 All extraneous metalwork shall be bonded to earth.
- 5.7.2 The switchboard frame earth shall have a connection at each end of the switchboard. Each of the two connections shall be individually capable of meeting the rated short time and the peak withstand current rating of the switchgear. A connection shall be provided from each of these points to the earth marshalling bar.
- 5.7.3 All earth connections shall be marshalled at a bar on the rear wall at the centre rear of the switchboard. Two connections shall be taken from the marshalling bar to the earth mat. Each of the two connections shall be individually capable of meeting the rated short time and the peak withstand current rating of the switchgear. Each connection shall be labelled.
- 5.7.4 Ancillary equipment panels shall be bonded using 70mm² copper conductors. The housing and switchboard shall be bonded using 32mm x 4mm copper strip.
- 5.7.5 The earthing shall be designed to safely discharge a prospective earth fault current of up to 2000 amps for up to 10 seconds. Any variation to this shall be specified in Appendix C.
- 5.7.6 Two earth connection points shall be provided at diagonally opposite corners of the housing. These shall be for connection of the housing metal case to the earth mat.

5.8 Cable Access

- 5.8.1 Main cable access shall be via a set of removable floor plates. These shall be positioned below the switchgear and fitted such that they effectively seal from ingress of moisture and gas. Cables shall then pass into the bottom plate of the switchgear. The cable sheath to cable entry hole shall be sealed as it passes through each plate.
- 5.8.2 The space between the switchgear bottom plate and the floor plate shall be effectively included with the switchroom for environmental control.
- 5.8.3 Provision shall be made to bring in auxiliary cables via the floor. Provision shall be made for the entry of a 3 phase low voltage supply to the low voltage alternating current (lvac) board. Provision shall be made for the entry of earthing cables. These shall all be similarly sealed as the main cables. The cable schedule will be provided by Electricity North West.

5.9 Security

- 5.9.1 A security intruder alarm shall be fitted with a control panel fitted inside adjacent to the main entrance. The control panel shall be capable of using a 4 digit code to arm and disarm. A volt free normally open alarm contact, for use on a 48V system, shall be provided in order to provide alarm to the SCADA.
- 5.9.2 The security alarm shall be designed and installed to prevailing British and Industry Standards. The security alarm shall be installed by a member of National Security Inspectorate's (NSI) National Approval Council for Security Systems (NACOSS) or SSAIB (Security Systems and Alarms Inspection Board).
- 5.9.3 Each room shall have a PIR detector fitted. The switchroom shall have 2 PIR detectors. Each external door and pressure relief vent shall be fitted with a sensor. All entrances, including opening pressure relief vents, shall be alarmed.
- 5.9.4 Any gutters and downspouts shall be so fitted and protected such that they will not be a climbing aid to intruders.

5.10 Access Platforms, Steps and Handrails

Access platforms, steps and handrails shall be provided for all external doors. These shall be designed for a housing mounted at 300mm above ground level. For any variation on this mounting height the Tenderer shall allow for suitable steps. Metallic platforms, steps and handrails shall be fitted with connection points for earth bonding.

5.11 Lighting and Small Power

- 5.11.1 The internal lighting shall be installed to provide sufficient illuminance for the tasks to be performed. This shall be at least 130Lux at operating and working positions. The main switch shall be adjacent to the main door.
- 5.11.2 Emergency lighting shall be installed powered from the 110V battery and switched on from a loss of mains change over contactor. This shall only energise if the main lighting switch is on. The system shall utilise bulkhead luminaires so arranged to illuminate each final exit.
- 5.11.3 A minimum of four double sockets shall be installed for use by portable equipment. These shall be situated at low level on the housing wall, one near to the centre rear of the switchboard, one centre front of the switchboard, one at the desk position and one near to the main door.
- 5.11.4 The installation shall comply with BS 7671 Requirements for Electrical Installations, IEE Wiring Regulations, Seventeenth Edition.

5.12 Lightning Protection

The Tenderer shall risk assess the housing as required by BS EN 62305 and include all lightning protection measures. These shall be detailed in the installation and maintenance manual.

5.13 Fire Extinguishers

A minimum of one 9 kilo bulk powder (stored pressure) fire extinguisher shall be fitted in each operational room.

5.14 Base Interface and Fixing

- 5.14.1 The Tenderer shall ensure that the housing is suitable for mounting on six or eight landing points.
- 5.14.2 The Tenderer shall provide an option for extension legs to be fitted between the housing base fixing points and the landing points. These legs shall typically be 1000mm. The detail of this shall be included in Appendix C. With this option the supplier shall ensure that holding down bolts to the base fixing points on the housing are readily fitted to the legs on site, or are pre-fitted ready for connection at installation. The foundation side of the legs shall have predrilled holes to match holding down bolts pre-cast into the foundations
- 5.14.3 The Tenderer shall provide an option for a ring beam sub-frame of 'I' section steel as an interface between the foundations and the housing. This shall nominally be 300mm height. The detail of this shall be included in Appendix C. With this option the supplier shall ensure that holding down bolts to the base fixing points on the housing are readily fitted to the ring beam on site, or are pre-fitted ready for connection at installation.
- 5.14.4 It is intended that the ring beam shall be fitted to the foundations prior to the installation of the housing. The foundation side of the ring beam shall have predrilled holes to match holding down bolts pre-cast into the foundations. The ring beam shall also be fitted with a Duct Template to allow the cable ducts to be fitted in the correct position before the housing is fitted.
- 5.14.5 The Supplier shall provide holding down bolts for embedding into the foundations by the Electricity North West civil contractor. Alternatively, if agreed by Electricity North West, the Supplier shall provide drill and fix type holding down bolts. The Supplier shall specify the type and detail of the holding down bolts for approval by Electricity North West. The Supplier shall ensure that the interface to the foundations readily allows for drill and fix type bolts to be drilled for and fitted. The Supplier shall provide the minimum dimensions to avoid burst out on the foundations.

6. DOCUMENTS, DRAWINGS AND MANUALS

6.1 Format

All manuals shall be supplied as at least one copy each of paper and an electronic copy as a pdf file. All drawings shall be supplied as at least one copy each of paper, an electronic pdf file and an electronic .DWG file which is compatible with Autocad 2000.

6.2 Tender Documents, Drawings and Manual

- 6.2.1 Drawings and documents to be provided with the Tender for the housing are:-
- (a) Generic external general arrangement.
 - (b) Generic internal general arrangement.
 - (c) Generic arrangement of earthing.
 - (d) Generic lighting and small power arrangement and schematics.

- (e) Generic cable entry.
- (f) Generic QA and test programme for the main structure, auxiliary systems and fitting out.
- (g) Generic Civil Guide Drawing, fully dimensioned including details of all necessary weights, forces and support footing interface requirements including bolting down arrangements. All values to include required tolerances.
- (h) Structural calculations.

6.2.2 A generic operation and maintenance manual shall be provided which gives the nature, scope and frequency of works expected to be needed to practicably keep the housing safe, secure and fit for purpose.

6.3 Design Documents, Drawings and Manual

6.3.1 Design versions of the above generic drawings, documents and manual shall be provided by the Supplier at a maximum of two months after placement of order for comment and agreement from Electricity North West.

6.3.2 The design versions shall include site specific versions of the drawings specified in section 6.2 above. The design drawings shall also include an interface template giving the precise position and detail of all of the cable entry points including services, multicores and earthing cable as well as the main cables and positioning of spares for additional later units. The template shall also detail the mounting points and fixing down bolts.

6.4 As Installed Drawings and Manual

6.4.1 Immediately following installation the Supplier shall provide a site specific Installation and Maintenance Manual which will include all relevant information required by the Construction (Design and Management) Regulations (CDM) and in order to practicably keep the housing safe, secure and fit for purpose throughout its life expectancy.

6.4.2 Immediately following installation the Supplier shall provide site specific copies of all drawings that are up to date 'as installed'.

7. SCHEDULE OF PLANT AND APPARATUS TO BE INSTALLED

7.1 General

The switchgear, plant and apparatus to be installed will be provided by Electricity North West to the Tenderer as per Appendix C. This shall also specify responsibility for supply and installation of switchgear where this is Tendered separately, i.e. this does not preclude that the supply of the switchgear and housing could be from a single Supplier. The switchgear shall be that which is listed as approved in EPD307.

7.2 6.6kV and 11kV Switchgear

The detail of the arrangement of the 6.6kV and 11kV switchgear to be supplied and installed shall be as specified, in the relevant schedules of ES313 6.6kV and 11kV Single Busbar Indoor Switchgear (Cable Connected), by Electricity North West to the Tenderer. Also it shall specify if there is a nominated supplier, list of approved suppliers and if it is to be purchased by Electricity North West for free issue to the Tenderer.

7.3 33kV Switchgear

The detail of the arrangement of the 33kV switchgear to be supplied and installed shall be as specified, in the relevant schedules of ES312 36kV Single Busbar Indoor Switchgear (Cable Connected), by Electricity North West to the Tenderer. Also it shall specify if there is a nominated supplier, list of approved suppliers and if it is to be purchased by Electricity North West for free issue to the Tenderer.

7.4 Ancillary Apparatus

The detail of the items of ancillary apparatus to be installed in the housing shall be as specified by Electricity North West to the Tenderer. This specification shall define each time where it is to a particular Electricity North West specification or if it is of generic supply. Also it shall specify if there is a nominated supplier, list of approved suppliers and if it is to be purchased by Electricity North West for free issue to the Tenderer.

7.5 Marshalling Boxes

The housing will typically be a component part of a substation and will require connection of protection, control and communications wiring to other components and buildings. The interface of this connection shall normally require marshalling boxes. These shall typically be a protection marshalling box which contains 100 RSF1 terminals and a Control, Alarms and Indication marshalling box containing 300 RSF3 terminals.

7.6 Other Information to be Supplied by Electricity North West

- 7.6.1 A schedule of information and drawings, and the information and drawings, shall be provided to the Tenderer for essential information to match Electricity North West requirements. An example of this will include the 'multicore schedule'.
- 7.6.2 A schedule of documents such as Electricity Specifications (ES), CPs and EPDs, and the documents or relevant parts of the documents, shall be provided to the Tenderer for essential information to match Electricity North West requirements. An example of this will include ES312 36kV Single Busbar Indoor Switchgear (Cable Connected). This provision will not include relevant standards of a National or International Institute or organisation which are freely or commercially available.

8. PLANT AND EQUIPMENT INSTALLATION

8.1 General

- 8.1.1 This section details general standards that shall be met when doing the preparation, installation and assembly of the switchgear and ancillary plant and equipment into the housing.
- 8.1.2 All work shall be done to a standard such that the as-built life of a unit is not unduly reduced as a result of the preparation and assembly procedures included in this specification. (For example seals shall be made securely, without distortion, to ensure water cannot penetrate, thus avoiding oil contamination, short-circuits, corrosion, etc.) Care shall be taken to avoid damaging paintwork during preparation or assembly work. The standards listed here shall be maintained for all preparation or assembly work (even in cases where some dismantling may be necessary during final installation of the unit - eg for jointers to access cable boxes etc.) The apparatus shall be protected from moisture, humidity and temperature extremes at all stages of delivery, storage, preparation and assembly commensurate with the design and materials of the apparatus and its components.
- 8.1.3 A written method statement shall be provided by the Tenderer for the plant preparation, installation and assembly work undertaken.
- 8.1.4 The Supplier shall be responsible for all liaisons with other Suppliers and Contractors to ensure delivery, installation and testing of installed switchgear, plant and apparatus are undertaken to schedule and specification.

8.2 Securing fixings, making waterproof seals and electrical connections

- 8.2.1 All fixings shall be tightened to the appropriate torque setting. All neoprene or rubber gaskets, such as those around test apertures, shall be secured (using appropriate adhesive) and greased as per suppliers' recommendations prior to being fitted. Cork Gaskets shall not be reused. Sealant shall be applied to mating surfaces where necessary to avoid the ingress of water.
- 8.2.2 No distortion of completed unit or assembly (or individual parts) due to preparation or assembly work is acceptable. Electrical connection points shall be cleaned prior to being made, then secured appropriately to ensure good electrical contact.

8.3 Quality Control Documentation

A Quality Control Checklist (see form in Appendix B) shall be generated by the supplier prior to the start of a job and shall be completed and signed off at the end of that job. This document is in addition to the contractors own quality control documentation and that required by ES312 and ES313. The contractor shall provide an electronic copy of all quality control documentation to the Electricity North West Plant Policy Manager for subsequent attachment to the Master Asset Management System (MAMS) record.

8.4 Personnel doing the work

Any plant preparation or assembly procedure shall only be done by qualified fitting staff who are trained and authorised to work in the appropriate environment, and who are trained and authorised to use all the equipment necessary to do the job. Contractors shall maintain written records of training of personnel involved in this work. Tenderers shall specify the competency and assessment of the staff to undertake this work.

8.5 Initial Inspection

8.5.1 Before installation all plant and equipment shall be checked as follows:

- (a) All permanent labels, etc (eg unit identification plate) shall be secure and legible.
- (b) Plant identification details shall be noted and recorded.
- (c) Only units containing oil: these shall be checked for signs of oil leaks (particularly around gaskets and seals), ensuring, as far as is reasonably practicable, that the gaskets and seals are correctly seated and in good condition.
- (d) Only units containing SF₆: the reading on the pressure indicator shall be checked and the temperature shall be measured and recorded as well.
- (e) Check the correct operation of all switching devices and interlocks.
- (f) The integrity of the external connectors shall be checked.
- (g) The exterior of the unit shall be checked for any obvious defects, eg dents, bent pins, etc.
- (h) If any obvious damage or out-of-tolerance items are discovered, the unit shall be labelled appropriately and returned to the supplier for repair or replacement. The details shall be recorded and passed on to Electricity North West for statistical analysis.

8.5.2 All defects found shall be reported to the Electricity North West Plant Policy Manager.

8.6 Supply and Installation

8.6.1 6.6kV and 11kV switchgear shall be procured and installed to the requirements of ES313.

8.6.2 33kV switchgear shall be procured and installed to the requirements of ES312.

8.6.3 33kV switchgear which has framecheck bus zone protection shall be installed with insulated mountings to provide earth connectivity segregation from the housing.

8.6.4 Multicore and multipair cabling shall be as specified in ES400C13 with the exception that these cables which are wholly internal to the housing may be un-armoured.

- 8.6.5 Multicore and multipair cabling shall be fixed by cleating or on cable racking and shall not be installed in trunking.

9. PLANT AND EQUIPMENT TESTING

9.1 General

- 9.1.1 All switchgear shall be function tested to all operational positions. Locking off in accordance with operational procedures and safety rules shall be included. Open and close timings shall be undertaken. Operations shall be included from the telecontrol outputs. Testing may be undertaken at the factory installation where practicable. Equipment which has not been finally connected, or has had connection/function unmade or removed for transportation, shall be tested/re-tested after installation on site.
- 9.1.2 All secondary wiring, including multi-core and multi-pair cabling, shall be point to point tested.
- 9.1.3 Primary injection testing of protection shall be undertaken. Analogue meters and outputs to telecontrol outstation cabinet terminals or marshalling box shall be included.
- 9.1.4 All alarms and indications shall be tested from source to final indication, including into the telecontrol outstation cabinet terminals.
- 9.1.5 All primary connections shall be tested with a low resistance ohm-meter (Ducter).
- 9.1.6 The Supplier shall provide a schedule of tests to Electricity North West for approval. This schedule shall detail which tests are to be undertaken at the factory and which are to be undertaken after installation on site. The approved schedule will be used as part of the quality control documentation.
- 9.1.7 The testing shall include the requirements of CP342, Commissioning of Electrical Equipment to be connected to the 132kV, 33kV and 11/6.6kV Primary Networks. Testing shall also be undertaken to the requirements of ES312 or ES313.

10. DELIVERY AND INSTALLATION

10.1 General

- 10.1.1 The Contract Works shall be delivered by road and off-loaded to its designed location by the Supplier during normal working hours at the substation given on the Purchase Order. The Supplier shall provide method statements and risk assessments for all site works.
- 10.1.2 Prior to placement of the order the Supplier shall undertake a site inspection to confirm that the delivery and installation is practicable and that there are no exceptional requirements.
- 10.1.3 During installation and commissioning on site all defects shall be recorded and rectified.
- 10.1.4 The supplier shall ensure that the housing is installed level and provide and fit any necessary shims.

11. DOCUMENTS REFERENCED

Health and Safety at Work Act 1974

Control of Substances Hazardous to Health Regulations 2002

Manual Handling Operations Regulations 1992

Construction (Design and Management) Regulations 2007

BRE Report TCR 20/97

ISO 9000 Quality Systems. Guide to Dependability Management.

ISO 12944 Paints & Varnishes – Corrosion Protection of Steel Structures by Protective Paint Systems.

BS EN 14001 Environmental Management Systems Requirements with Guidance for Use

BS EN 62305 Protection against lightning

BS 4800 Schedule of paint colours for building purposes

BS 7671 Requirements for Electrical Installation (IEE Wiring Regulations 17th Edition)

ES 312 36kV Single Busbar Indoor Switchgear (Cable Connected)

ES 313 6.6kV and 11kV Single Busbar Indoor Switchgear (Cable Connected)

ES 326 Substation Security Doors

ES 400C13 Multipair and Multicore Auxiliary Cables

EPD307 Equipment Approved for use on the Electricity North West Network

EPD311 Approval of Equipment

CP311 Equipment Approval Process

CP342 Commissioning of Electrical Equipment to be connected to the 132kV, 33kV and 11/6.6kV Primary Networks

LPS1175 Requirements and testing procedures for the LPCB approval and listing of intruder resistant building components, strong points, security enclosures and free standing barriers.

12. KEYWORDS

Construction; Switchgear; Housing; Substation.

APPENDIX A

SELF CERTIFICATION CONFORMANCE DECLARATION

CLAUSE BY CLAUSE CONFORMANCE WITH THIS ES

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

Conformance declaration codes

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

Assessor

Name:

Company

Signature

Date

Clause/Sub- Clause		Requirement	Conformance Code	Remarks (Must be completed if Conformance Code is not C1)
2		Scope		
4	1	Product not to be Changed		
4	2	Electricity North West Technical Approval		
4	3	Quality Assurance		
4	4	Formulation		
4	5	Identification Marking		
4	6	Minimum Life Expectancy		
4	7	Product Conformity		
5	1	Housing Size		
5	2	Housing Main Material		
5	3	Requirements for Internal Arc		
5	4	Roof		
5	5	Doors and Fittings		
5	6	Internal Environmental Controls		
5	7	Earthing		
5	8	Cable Access		
5	9	Security		

Clause/Sub- Clause		Requirement	Conformance Code	Remarks (Must be completed if Conformance Code is not C1)
5	10	Access Platforms, Steps and Handrails		
5	11	Lighting and Small Power		
5	12	Lightning Protection		
5	13	Fire Extinguishers		
5	14	Base Interface and Fixing		
6	1	Documents Drawings and Manual Format		
6	2	Tender Documents Drawings and Manual		
6	3	Design Documents Drawings and Manual		
6	4	As Installed Drawings and Manual		
7	5	Marshalling Boxes		
8	1	Plant and Equipment Installation General		
8	2	Securing Fixings, seals and connections		
8	3	Quality Control Documentation		
8	4	Personnel		
8	5	Initial Inspection		
8	6	Supply and Installation		
9	1	Plant and Equipment Testing General		

Clause/Sub- Clause		Requirement	Conformance Code	Remarks (Must be completed if Conformance Code is not C1)
10	1	Delivery and Installation General		

Additional Notes:

APPENDIX B

QUALITY CONTROL DOCUMENTATION

Company name		Preparation/Assembly location	
Contractor reference			
Destination Details			
Substation name		Substation number (if known)	
Plant Details			
HV Switchgear		Unit Name from Schedule Type	
Manufacturer's name		Date of Manufacture	
Serial number			
HV Switchgear		Unit Name from Schedule Type	
Manufacturer's name		Date of Manufacture	
Serial number			
HV Switchgear		Unit Name from Schedule Type	
Manufacturer's name		Date of Manufacture	
Serial number			
HV Switchgear		Unit Name from Schedule Type	
Manufacturer's name		Date of Manufacture	
Serial number			
HV Switchgear		Unit Name from Schedule Type	
Manufacturer's name		Date of Manufacture	
Serial number			

Factory Quality Checks

Unit Name from Schedule

--

Initial Checks at Receipt

Job details recorded ?

Initial inspection complete ?

HV Switchgear

Operations function ok?

Covers secured ?

Interlocks function ok?

Control Fuse(s) fitted ?

HV trip test complete ?

Earth connections complete ?

HV connections complete ?

SF6 Gas Pressure Correct ?

CT's correctly fitted ?

X56 locks fitted ?

VT correctly fitted?

Heating correctly fitted?

Destination Labels fitted ?

Dehumidification fitted?

Final Assembly

Ensure micro-ohmmeter readings are within range given in manufacturer's manual and record readings in uOhms (below): (If final torque applied on site, then note below for commissioning test)

R busbar to cable conn.			R busbar to left adjacent unit			R busbar to right adjacent unit		
Y busbar to cable conn.			Y busbar to left adjacent unit			Y busbar to right adjacent unit		
B busbar to cable conn.			B busbar to left adjacent unit			B busbar to right adjacent unit		

Destination labels fitted ?

LV connections made ?

HV connections made ?

Destination labels fitted ?

Final earth connections made ?

Danger of Death labels fitted ?

Locked off ?

SF₆ pressure OK ?

Cleaned ?

Assembly secure and stable ?

'Tested' label, and Protection Test Results attached?

Scratches touched up ?

Additional Comment ?

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Name		Signature		Date	
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APPENDIX C

SWITCHGEAR, PLANT & APPARATUS SCHEDULE

<u>Site Name and Location</u>				
<u>Date for completion of Installation and Testing</u>				
ITEM	REQUIRED Y/N & QUANTITY	SUPPLY AND DELIVERY (Tenderer/Electricity North West / Other)	INSTALL & TEST (Tenderer/ Electricity North West/ Other)	DETAIL
Switchgear (By Function) Incomers Bus-Section + Riser Feeder				
Space and provision for future additional switchgear				
Marshalling boxes				
110V Battery and Charger				
48V Battery and Charger				

Telecontrol Cabinet				
Protection Panels				
Alarm Annunciator Panel				
Tap Change Control Panels				
External Colour				
Earthing Design, Prospective Earth Fault Current				
Ring Beam Detail				
Extension Leg Detail				