



## Electricity Specification 312

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# 36kV Single Busbar Indoor Switchgear (Cable Connected)

## Contents

- 1 Introduction
- 2 Definitions
- 3 General Requirements for Approvals and Testing
- 4 Requirements for Type and Routine Testing
- 5 Standards
- 6 Design Features
- 7 General Clauses
- 8 Technical Clauses
- 9 Items Additional to ENA TS 41-36
- 10 Documents Referenced

Appendices: A to D.

Approved for issue by the

**Technical Policy Panel**

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Amendment No. Date	Brief Description and Amending Action
	<ul style="list-style-type: none"> <li>• Clause 8.9.3 Pilot wiring insulation level insulation.</li> <li>• Clause 9.12 Details for terminals required made more specific.</li> <li>• Appendix A Section 1 Protection and control relay requirements inserted.</li> <li>• Appendix B. Standard schematic drawing for 33kV fixed pattern switchgear inserted. All other drawing referred to ES 337.</li> <li>• Appendix C. Requirement for submission of GA and CD for most complicated circuit to be submitted with Tender inserted.</li> </ul> <p>Prepared by: G Bryson.</p> <p>Authorised by the Technical Policy Panel and signed on its behalf by:</p>
<p>0</p> <p>08/08/13</p>	<p>Issue 5</p> <p>New Template Applied.  Document Properties Updated.  Term Engineer replaced throughout.  References to UU and UUES replaced.  Section 7.4 updated to prevent tripping hazard.  Section 7.6 updated to ensure drawings are sent to the correct departments.  Section 9.2 updated to remove repeated bullet point.  FMECA defined in section 7.12.  Section 8.6 updated to utilise Type C Separable Connectors and Type 1 Inner Cone Connectors.  Section 8.7.1 updated to ensure that the CTs match the CB ratings and BS standard updated.  Section 8.7.3 updated to have neutral current CTs on incomers only, rating added and structure mounting option..  Section 8.7.6, 8.7.7 and Table 1 corrected for CT04 Maximum Im at kpv to 25mA.  Section 8.7.9 updated to enable the neutral ct to match exiting NERs where they are to be re-used.  Section 8.8.1 – BS reference updated.  Section 9.12 updated to a more reliable terminal block system.  Section 10 – Document references updated accordingly to match changes detailed above.  Appendix A – Relay requirements updated to match standard solutions. New option 2 added.  Appendix B – Drawing numbers updated due to Appendix A changes.  Appendix C updated to take into account of drawing revisions.  Appendix D updated to match the document changes.</p> <p>Prepared by: M A Kayes.</p> <p>Authorised by the Technical Policy Panel and signed on its behalf by: Paul Whittaker.</p>



## 36kV SINGLE BUSBAR INDOOR SWITCHGEAR (CABLE CONNECTED)

### 1. SCOPE

This Specification and attached schedules covers the general design specification of single busbar indoor metal-enclosed switchgear with integral protection and control for use on the 33kV system operated by Electricity North West Limited, hereinafter referred to as Electricity North West.

### 2. DEFINITIONS

<b>Approval:</b>	Sanction by the Electricity North West Plant Policy Manager that specified criteria have been satisfied.
<b>Contract:</b>	The agreement between Electricity North West 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.
<b>Contractor:</b>	The person or person's firm or company, including personal representatives, successors and permitted assigns, whose Tender has been accepted by Electricity North West.
<b>ENA TS:</b>	Energy Networks Association Technical Specification.
<b>Specification:</b>	The Specifications and schedules (if any) agreed by the parties for the purpose of the Contract.
<b>Sub-Contractor:</b>	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.
<b>Supplier:</b>	Any person or person's firm or company who supplies goods to Electricity North West or to its Contractor.
<b>Tender:</b>	An offer in writing to execute work or supply goods at a fixed price.
<b>Tenderer:</b>	The person or person's firm or company, including personal representatives, successors and permitted assigns, invited by Electricity North West to submit a Tender.
<b>Words:</b>	Words importing persons shall include firms and corporations; words importing the singular only, also include the plural, and vice versa where the context requires.
<b>Work:</b>	All materials, labour and actions required to be provided or performed by the Contractor under the Contract.
<b>Writing:</b>	Any manuscript, typewritten or printed statement under seal or hand as the case may be.

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

#### **3.2 Electricity North West Technical Approval**

3.2.1 The Tenderer shall submit, with this Tender, proposals for 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.

3.2.2 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. Acceptance of this evidence shall be at the discretion of the Electricity North West Plant Policy Manager but will not be unreasonably withheld.

3.2.3 Approval shall be 'factory specific' and is not transferable to another factory without the written approval of the Electricity North West Plant Policy Manager.

3.2.4 The Supplier and product shall comply with all the relevant requirements of Electricity North West documents EPD311 and CP311.

#### **3.3 Quality Assurance**

3.3.1 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.

3.3.2 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.

3.3.3 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.

3.3.4 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.

3.3.5 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.

3.3.6 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.

### **3.4 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.

### **3.5 Identification Markings**

3.5.1 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 Approved Description and Commodity Code Number.

3.5.2 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.

### **3.6 Minimum Life Expectancy**

The minimum life expectancy of all products covered by this Specification is 40 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 Plant Policy 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 the Supplier's 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 Plant Policy 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 Plant Policy Manager.

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

### **4.3 Requirement for on site tests**

These will normally be included within the scope of on site commissioning, but may be included if appropriate.

## **5. STANDARDS**

Switchgear shall comply with the stated ENA TS 41-36 except where varied by this Specification. Equipment that complies with ENA TS 41-26 previously approved for use in Electricity North West will also be considered.

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

## **6. DESIGN FEATURES**

### **6.1 General**

The overall arrangements of the installation shall enable a straightforward operating regime. Each switching component, its operational state and means of control shall be clearly and instantly recognisable.

The completed installation shall provide reasonable levels of access for any maintenance work which may be required throughout the lifetime of the equipment. Access levels for regular operation, inspection, or maintenance shall be good, and where necessary fixed aids such as platforms or ladders shall be provided as necessary in order to achieve this. Preference shall be given to plant which only requires ground level access to all working positions. All programmable relays shall be sited below 1.8m. Method statements describing access arrangements and accompanying risk assessment shall be provided where access is required on more than one working level.

## 6.2 Handling of SF<sub>6</sub> and Decontamination Procedures

The Tenderer shall include for the removal of any SF<sub>6</sub> bottles required for the installation of the switchgear.

In certain situations it will be necessary to access enclosures where sulphur hexafluoride (SF<sub>6</sub>) has been used for insulation or arc extinction, e.g.

- Switchgear modification to correct manufacturing or material defect.
- Examination following failure.
- Examination following leak of SF<sub>6</sub>.
- Maintenance.
- Disposal of switchgear at end of life.

Whilst Electricity North West has a procedure for safe decontamination of enclosures containing SF<sub>6</sub> it is not envisaged that Electricity North West will undertake such work except in an emergency. The original equipment manufacturer, its successor or a suitable Contractor, will be expected to assist as necessary in any such work and consequent actions. The Supplier shall describe how it intends to discharge this obligation.

When the equipment reaches the end of its working life it will have to be decontaminated and disposed of safely. It is important that this is considered in the design of the equipment. Tenderers shall provide a detailed procedure by which each type of switchgear offered under this Tender may be safely de-gassed and decontaminated prior to disposal at the end of its life. This applies to enclosures that have contained SF<sub>6</sub> as an insulator as well as those where SF<sub>6</sub> has been used as an arc interrupting medium.

It is a requirement of this Specification that Tenderers have procedures and safe working practices in place to:

- a) Decontaminate the equipment and site as necessary and recover switchgear for examination/disposal as required.
- b) Decontaminate the equipment on site or some other location as required to carry out modifications.
- c) Decontaminate the equipment prior to disposal.

Tenderers shall provide the following information: -

1. Mass of SF<sub>6</sub> in kg for each type and variant of switchgear offered.
2. Details of procedures for handling new and contaminated SF<sub>6</sub>.
3. Details of procedures for decontaminating failed SF<sub>6</sub> equipment and the associated sites/substations.
4. Details of procedures for decontaminating SF<sub>6</sub> equipment prior to carrying out modifications.

5. Details of the procedure by which each type of switchgear offered under this Tender may be safely de-gassed and decontaminated prior to disposal at the end of its life and disposed of in accordance with current waste transfer and disposal directives. This shall cover enclosures (a) where SF<sub>6</sub> is used as an insulator and (b) where SF<sub>6</sub> is used as an arc interrupting medium.

### 6.3 Internal Arc Tested Equipment

Units offered shall have completed internal arc testing in accordance with ENA TS 41-26 or 41-36 and shall be supported by test evidence, from a recognised Short Circuit Testing Station, of the ability of a unit to vent in a safe and predictable manner in the event of an internal arc occurring.

Manufacturers shall also provide guidance information on the correct positioning of the unit within the substation enclosure so as not to invalidate the tests. This guidance shall include the following for each type of switchgear offered.

- The arrangements of the enclosure in which internal arc testing was carried out, highlighting differences from those specified in ENA TS 41-36 section 1.5.101.
- Drawings showing the venting volumes required for fault ratings up to 21.9kA.
- The need for venting ducts is not desirable and Tenderers shall indicate the circumstance under which they consider venting would be necessary, so that such situations can be avoided.
- If venting ducts are required, a drawing of the interface trunking that shall be attached to the vent on the switchgear suitable for connection to Electricity North West standard trunking with external cross section of 342mm by 342mm.

A copy of this information shall be included with the Tender but an additional copy shall be sent to the Electricity North West Plant Policy Manager.

## 7. GENERAL CLAUSES

### 7.1 Extent of Contract

This Specification lists Electricity North West ' general requirements for indoor metalclad switchgear for use on the 33kV electricity distribution network and is complementary to ENA TS 41-36.

For 132/33kV transformer incomers and busbar protection the relay and control panels are separately specified in Electricity North West Specification (ES) 337 and will be the subject of a separate enquiry. In general, all other protection (as detailed in Schedule A) shall be mounted on the switchgear. Induction disc relays must preferably not be mounted on doors or removable panel covers. Where this is unavoidable guard relays must be fitted to prevent inadvertent relay operation when doors are opened or closed.

Standard switchgear units are listed in Schedule A of this specification. Where requirements do not conform to any of these standard arrangements a specific enquiry will be issued giving exact details of deviations from the equipment listed in Schedule A; the technical clauses of this specification shall apply to all such enquiries.

The testing and commissioning of all remote equipment will be carried out by Electricity North West but the Contractor shall be responsible for correcting all defects found at the switchgear end by Electricity North West ' testing staff.. Tests to be conducted by the Contractor are specified in Section 7.9.

## **7.2 Site and Delivery**

The Contractor is responsible for delivery and off-loading during normal working hours to an Electricity North West ' Substation or depot at the address given either on the Purchase Order or in Schedule A of a particular enquiry.

## **7.3 Time for Completion**

The period of time required from the placing of an order until the Contractor's Works will be completely finished and delivered shall be stated in Schedule D of this or a particular enquiry.

## **7.4 Work to be Executed at Site**

If specific mounting arrangements are required, the Contractor is responsible for supplying and setting out these foundation arrangements in the substation, including any steelwork necessary to mount the switchgear over cable trenches. Where channel foundations (Unistrut) are supplied, these shall not be a tripping hazard and cater for the ultimate capacity of the switchhouse, which will be stated on the general particulars of the enquiry.

Where the Contract includes erection by the Contractor all cutting away and making good of brickwork, etc., shall be the responsibility of Electricity North West except small fixing holes for the switchgear which shall be the responsibility of the Contractor.

Where the Contract includes erection by the Contractor, all relevant health and safety legislation shall be complied with and risk assessments and method statements shall be prepared.

Care shall be taken to avoid damage to any floors, doors, or any other parts of the building. The Contractor will be required to make good at his own expense any damage caused.

## **7.5 Manufacturer**

The whole of the plant shall be manufactured in the works of the Contractor or in the works of an approved sub-contractor. The Tenderer shall state in Schedule E of this or a particular enquiry the names of all such sub-contractors and address of works.

## **7.6 Drawings and Maintenance Instructions**

General arrangement drawings shall be submitted as per Appendix C. These drawings shall include overall dimensions, headroom for erection and operation, withdrawal space where appropriate, and positions of main and multicore cables.

On receipt of the first order the Contractor shall submit drawings at any early date on CD-ROM in an AutoCAD (.dwg) format and one paper print maximum size A1 of all diagrams and drawings to the Electricity North West Plant Policy Manager and Electricity North West Grid and Primary Design Manager for approval. All further orders the Contractor shall submit the drawings to Electricity North West Grid and Primary Design Manager.

A copy of all installation, operation and maintenance manuals shall be submitted with the Tender. These manuals shall, preferably, be on a CD-ROM in an Adobe Acrobat format.

All equipment shall be in accordance with Electricity North West' current standard schematic drawings and multicore schedules, which shall be registered with the Contractor.

## **7.7 Spare Parts and Tools**

A set of tools and a container as required for the operation and maintenance of the switchgear at any one substation shall be provided. Where current ratings above 800A require additional tools, these shall be listed and priced separately.

Spare parts which the Contractor recommends, including contacts, closing and tripping coils, etc. shall be enumerated as part of this or a particular enquiry and a separate price given for each item.

## **7.8. Portable Testing Plugs and Integral Test Devices**

The testing connections and associated components shall be capable of withstanding the testing requirements of BS5227 but, in addition, shall be insulated to withstand 75kV for 15 minutes. They shall be capable of carrying 200A continuously.

In order to assist in cable fault location the contact resistance measured from the terminals for the connection of the test leads to the terminals for connection of the main outgoing cables shall not be greater than 200 microhms.

Where separate sets are provided for primary injection these shall be listed and priced separately.

Where separate sets are necessary for primary injection into VT spouts, these shall be listed and priced separately.

## **7.9 Inspection and Tests**

### **7.9.1 Works Inspections**

Routine inspections of the plant at the Contractor's Works will not normally be carried out, but the Electricity North West Plant Policy Manager reserves the right to carry out such inspections. Inspection of the first switchboard of a new design completed will however be required at the Contractor's works before delivery.

Not less than seven days notice of all inspections and tests shall be given to the Electricity North West Plant Policy Manager in order that he or his representative may be present if he so desires.

All apparatus shall be routine tested at the manufacturer's works and at site in accordance with the appropriate BS. Electricity North West reserves the right to witness routine tests at the manufacturer's works. Test certificates for all tests shall be supplied in duplicate on a CD-ROM in an Adobe Acrobat format.

### **7.9.2 Tests on Site and Documentation**

The Contractor shall be responsible for: -

- The power frequency voltage tests and main circuit resistance tests after erection on site.
- Testing all integral control, alarm and protective equipment to ensure that it functions correctly.

- Performing on site magnetisation curves on all current transformers, the results of which are to be included in a report.
- Buswiring and interlocking tests on the completed switchboard.
- Performing tightness checks on all protection and control wiring terminals relays and instruments.
- Any other tests required to prove the switchboard has been manufactured and installed correctly.
- The Contractor shall present a copy of all hand written on site test documentation to the Electricity North West site engineer prior to leaving site. A final PDF copy shall be issued to the Electricity North West design engineer within two weeks of the installation being completed.

### **7.10 Disposal of Switchgear or its Components**

Tenderers shall provide details on how to dispose of the switchgear and its components to ensure compliance with the various waste management regulations [Environmental Protection Act 1990 (Part II); Special Waste Regulations 1996; Waste Management Licensing Regulations 1994; Control of Pollution (Amendment) Act 1989]

### **7.11 Manual Handling**

Tenderers shall supply a Risk Assessment on the manual handling required for installation and operation of the switchgear.

### **7.12 Failure, Modes, Effect and Cause Analysis (FMECA)**

Tenderers shall carry out a FMECA or equivalent study for each type of equipment offered. A copy of this study should be provided with the Tender documents.

## **8. TECHNICAL CLAUSES**

### **8.1 General Requirements**

This specification is complementary to ENA TS 41-36 and clause numbers in brackets refer to that document. Selection of options for a particular enquiry is indicated in Schedule C. Additional details given in this section are normally aspects of good design, but where they involve extra cost this shall be priced separately.

This Contract covers 36kV indoor non-oil single busbar extensible metalclad switchgear to Electricity North West ' requirements as detailed in this Specification. Switchboards will be selected from those units detailed in Schedule A.

All incidental items shall be included, whether specified in detail or not, as required to secure reliability, economy, safety, and convenience of operation.

Means shall be provided for the easy lubrication of all bearings, moving parts and mechanisms where necessary.

Components, which may suffer deterioration in service, shall be removable as complete assemblies for maintenance or replacement.

## 8.2 System Earthing

The switchgear is required for use on Electricity North West three phase, 50 Hz, 33kV electricity distribution network with the neutral earthed either through an impedance or directly at the option of Electricity North West. Generally the preferred arrangement is earthed at the supply point through two neutral earthing resistors, each restricting the maximum zero sequence current to 1000A.

## 8.3 Common Ratings (refer to clause 1.4)

Rated Voltage	36kV
Rated normal current circuit breakers	800A, 1250A, 2000A
busbars	1250A, 2000A
Rated short circuit current	21.9kA minimum

Rating plates shall show the actual ratings to which the equipment is certified not that of the system on which it will operate.

## 8.4 Electrical Endurance (refer to clause 2.4.111)

The manufacturer shall state the number of breaking operations the circuit breaker is capable of at different fault levels (25%, 50%, 75% and 100% of rating) and the basis on which the information is given.

## 8.5 Operating Mechanism

### 8.5.1 Dependent Power (refer to clause 1.5.5)

If this type of mechanism is used then, a magnetic actuator is preferred.

### 8.5.2 Stored Energy (1.5.6)

If this type of mechanism is used then, stored energy operation by means of energy stored in a motor-charged spring with manual and electrical release is preferred.

## 8.6 Cable Terminations (refer to clause 1.5.103.1.101)

Unfilled terminations are required. Unless previously approved, drawings of cable boxes complete with all relevant design information shall be provided for assessment. Cable box bushings shall comply as follows:-

1. For all units rated upto and including 1250A shall utilise Type C outer cone bushings in accordance with BS 50181:2010 Table 1 Type C. All gland plates should be equipped with connections for initial and future cables.
  - a. Type C1 shall be used for units rated at 800A.
  - b. Type C2 shall be used for units rated at 1250A.

Alternatively units up to 1250 amps may utilise cable terminations in accordance with EN50181, Type 1 bushings (outer or inner cones).

2. For all 2000A rated units multiple Type C bushings or Type 1 Inner Cone Bushings compliant with BS50181:2010 Table 3 shall be used.

The Cable boxes shall have provision for a maximum of:-

- Two cables per phase on all units rated upto and including 1250A. Where Type C connectors are utilised; provision shall be for a minimum of one elbow and one coupling connector termination. However this preferred arrangement may be varied when a voltage transformer connection is also required. Agreement to the suggested arrangement shall be sought from the Electricity North West Cable Policy Manager), and
- Four cables per phase on all units rated in excess of 1250A and any required connectors to connect voltage transformers where required.

For all connections onto Oil barrier bushings the terminations shall be the equivalent of those listed above and shall be in accordance with BS50181:2010.

Provision shall be made for earthing individual copper screens. This shall take the form of a set of earth bars mounted on the base of the cable box. This internal cable box earthing shall be connected to the external true earth bar via bushings, which shall withstand a test voltage of 10kV dc.

Means shall be provided for fixing cable supports.

The expected type of cable to be installed and type of glands to be provided will be stated in the enquiry documents.

## 8.7 Current Transformers (refer to clause 10.2)

### 8.7.1 Type

Current Transformers shall in general comply with BS EN61869-2:2012, but shall also comply with the additional requirements of ENA TS 35-17 for Class X (PX) Current Transformers. They shall be of the bar primary low reactance type.

Where current transformers are required for metering purposes the performance, testing and certification shall be in accordance with ES501.

The performance characteristics of current transformers are given in Tables 1 and 2.

Magnetising curves of all current transformers shall be submitted for approval, to the Electricity North West Protection Policy Manager, unless previously approved by Electricity North West as a standard. The manufacturer shall carry out mag curve tests on all installed current transformers as part of the routine factory tests.

The thermal and mechanical rating of the current transformers shall not be less than that corresponding to the rating of the switchgear to which they are connected.

All current transformers shall be rated to carry the maximum rated primary current of the associated circuit breaker. Where dual ratio current transformers are specified, the current transformers shall be rated to carry the maximum rated primary current on the lowest turns ratio tap. This shall not preclude the maximum current being carried on the highest turns ratio tap.

The rating plate for the current transformer shall clearly show the serial number, primary and secondary rated current, output and accuracy class. **In addition** the rated continuous thermal current of the current transformer **shall be clearly marked** on the current transformer rating plate.

The manufacturer shall provide copies of all test data for the current transformers, this to include the type, routine and any special test reports that have been carried out in accordance with BS EN 61869-2 or ENA TS 35-17 for Class X current transformers.



### **8.7.2 Accommodation and Earthing**

All current transformer secondary connections shall be earthed (each group separately) at the switchgear, except bus-zone current transformers which shall be earthed at the busbar protection panel. Test windings shall be earthed separately at each switchgear unit. See relevant schematic diagrams.

Where there is more than one set of protective current transformers, those operating the main protection of the outgoing circuit shall be placed nearest to the busbars. Current transformers for busbar protection shall be placed farthest from the busbars so that the main protection zone overlaps the busbar protection zone. Metering current transformers shall be connected in the outer phases. The exact location of each current transformer shall be submitted for the approval of the Electricity North West Protection Policy Manager. An earthed metal screen shall be provided between the primary conductor and the secondary winding.

### **8.7.3 Neutral Current Transformers**

Neutral current transformers shall be provided with the switchgear for all incomer panels and will be mounted on equipment provided under other Contracts. The current transformers shall be suitable for outdoor location and shall be suitable for mounting on a post structure. The current transformer shall preferably weigh no more than 50kg. All Neutral Current Transformers (CT) characteristics shall be matched to those of the main CT05 characteristics and shall be a bar connected primary type rated at 1000A.

### **8.7.4 Testing Facilities**

Test windings are to be provided on all current transformers for busbar protection, so designed that a current of 10 ampere in the auxiliary winding corresponds to full load primary current on the higher ratio where applicable. Similar test windings are to be provided on all other current transformers, except where facilities are provided for carrying out primary injection testing. It shall be noted that approval will not be given to methods of testing which involve inserting bushings into a cable box. The connections from the auxiliary windings shall be brought out to accessible terminals within the LV compartment.

Buswiring, test connections, etc. shall be provided as shown on the relevant schematic diagrams (see Appendix B).

### 8.7.5 Feeder and Outgoing Transformer Circuits:

Main Protection (CT01):

- 3 off - 1/400/600 turns ratio
- Current rating to match that of the switch unit.
- On 1/600 tap:
  - Minimum kneepoint voltage (kpv) -  $(300 + 20R_{ct})$  volt
  - Maximum CT resistance ( $R_{ct}$ ) - 5 ohm
  - Maximum Magnetising current ( $I_m$ ) at kpv - 40mA

Backup Protection (CT02):

- 3 off - 1/400/600 turns ratio
- Current rating to match that of the switch unit.
- On 1/600 tap -
  - Minimum kneepoint voltage (kpv) -  $(200 + 20R_{ct})$  volt
  - Maximum ct resistance ( $R_{ct}$ ) - 5 ohm
  - Maximum Magnetising current ( $I_m$ ) at kpv - 40mA

Busbar Protection (CT03):

- Main Zone CTs - 3 off - 1/100/1000 turns ratio (i.e. with 10 ampere test winding)
- Current rating to match that of the switch unit
- Minimum kpv - 300 volt on 1/1000 ratio
- Maximum CT resistance - 6 ohm
- Maximum Magnetising current ( $I_m$ ) at kpv - 25mA
- Check Zone CTs (only required if frame leakage check scheme cannot be used with switchgear)
- As main zone CTs (CT03)

### 8.7.6 **Bus - Section Unit**

Busbar Protection (CT04):

- 2 off, 3 phase sets of current transformers overlapping the bus-section unit
- Main Zone CTs - 1/100/1000 turns ratio (ie with 10 ampere test winding)
- Current rating to match that of the switch unit
- Maximum kpv - 300 volt on 1/1000 ratio
- Maximum CT resistance - 6 ohm
- Maximum  $I_m$  at kpv - 25mA

Measurement current transformer (CTM1):

- 1 off (fitted in centre phase) CTM1
- 2000/1200/1 ratio 10VA Class 0.5 (on 2000/1 ratio)
- Current rating to match switch unit

***(Alternative current transformers for bus-section unit where specified)***

In place of the ammeter current transformer on the bus-section unit, one set of three current transformers shall be provided with similar ratio suitable for operating an IDMT relay and an ammeter.

### 8.7.7 **Incoming 132/33kV Transformer Circuits**

Main Protection (CT05):

- 3 off - 1/800/1600 turns ratio
- Current rating to match that of the switch unit
- On 1/1600 tap:
  - Minimum kneepoint voltage (kpv) - 400 volt
  - Maximum CT resistance ( $R_{ct}$ ) - 6 ohm
  - Maximum Magnetising current ( $I_m$ ) at kpv - 20mA

Backup Protection (CT05):

- Same as main protection

AVC CT (CT11)

- 1 off (fitted in centre phase)
- 1600/800/1 ratio 40VA Class 1.0 (on 1600/1/ratio)

Measurement (CTM1):

- 2 off (fitted in outer phases)
- 2000/1200/1 ratio 10VA Class 0.5 (on 2000/1 ratio)
- Current rating to match switch unit

Busbar Protection (CT04):

- Main Zone CTs - 3 off - 1/100/1000 turns ratio (i.e. with 10 ampere test winding)
- Current rating to match that of the switch unit
- Minimum kpv - 300 volt on 1/1000 ratio
- Maximum CT resistance - 6 ohm
- Maximum  $I_m$  at kpv - 25mA
- Check Zone CTs (only required if frame leakage check scheme cannot be used with switchgear)
- As Main Zone CTs (CT04)

### **8.7.8 Outdoor 33kV Neutral:**

Core 1 - CT06 Core 2 - CT21

- Core 1 - 1/800/1600 turns ratio
- 1000A Current rating (iii)
- Minimum kneepoint voltage (kpv) - 400 volt
- Maximum CT resistance ( $R_{ct}$ ) - 6 ohm
- Maximum Magnetising current ( $I_m$ ) at kpv - 20mA

Core 2 - 1000/1 ratio 15VA5P10

### 8.7.9 Busbar Protection Frame Leakage Check CT (CT07) (if required)

- 1/20/200 turns ratio (ie including a 10ampere test winding)
- 200A current rating
- Minimum kneepoint voltage (kpv) - 75 volt
- Maximum CT resistance ( $R_{ct}$ ) - 3 ohm
- Maximum magnetising current ( $I_m$ ) at kpv - 100mA

**Table 1 - Class X Protection Current Transformers**

Specification Reference	Turns Ratio	Minimum Knee Point Voltage (kpv)	Maximum Secondary Winding Resistance (Ohm)	Maximum Secondary Excitation Current at $V_k$ (mA)	See Notes/ Rated Primary Current (A)
CT01	1/400/600	$20R_{ct}+300$	5.0	40	(i) (ii)
CT02	1/400/600	$20R_{ct}+200$	5.0	40	(i)
CT03	1/100/1000	300	6.0	25	(i)(iii)
CT04	1/100/1000	300	6.0	25	(i)(iii)
CT05	1/800/1600	400	6.0	20	(i)(ii)
CT06	1/800/1600	400	6.0	20	1000(iiii)
CT07	1/20/200	75	3.0	100	200(iii)

**Table 2 – Other Current Transformers**

Specification Reference	Turns Ratio	Output VA	Class	See Notes/ Rated Primary Current (A)
CT11	1600/800/1	40	1.0	(i)(ii)
CT21	1000/1	15	5P10	1000
CTM1	2000/1200/1	10	0.5	(i)(ii)

Notes:

- (i) Rated primary current is defined as the rated current of the associated switchgear.
- (ii) For dual ratio current transformers the characteristics are related to the maximum secondary turns
- (iii) 10ampere test winding. Separate winding.
- (iiii) The standard rating shall be 1000A. Where an existing NER is to be re-used the CT current rating shall be specified at design stage.

## 8.8 Voltage transformers (refer to clause 10.3)

The following additional requirements are to be met: -

- Two sets of low voltage fuses and links per phase are required.
- Rated voltage factor 1.9. Rated time 30 seconds. Primary winding earthed. (Note: The VT primary winding star point and earth connection shall not be located in the same compartment or junction box as the VT secondary fuses and links).
- Earth connections shall be reasonably accessible to provide for insulation testing. Access is only required when the voltage transformer is isolated. Preferably some means of preventing re-energisation without completing the earth connection is required.
- The arrangement of fuses, links and earthing shall be in accordance with the appropriate Electricity North West diagrams. Secondary fuses shall be sea green (BS 4800 Colour 6-071) in colour and fitted with 16A fuse-link of a type approved by the Electricity North West Plant Policy Manager.
- Where voltage transformers are required for tariff metering purposes the performance, testing and certification shall be in accordance with ES501.
- It is preferred that isolation of the VT shall not require the use of tools. If plug in type connectors are used for VT isolation the manufacturer shall supply details on the number of removals / insertions allowed before maintenance is required on the connector.

### 8.8.1 Voltage transformers for Feeder or Feeder/Transformer units

The voltage transformer shall be of the 3-phase 5-limb, or equivalent, type with star-connected primary wound for 19.05kV ( $33/\sqrt{3}$ kV) per limb. The primary neutral shall be earthed. The secondaries shall be star-connected and wound for 63.5V per limb. The voltage transformer shall be complete with appropriate isolation and disconnection facilities, safety shutters and primary connections. One spare set of HV fuse links shall be provided.

The voltage transformer shall have a rated residual burden of 100VA. The rated burden of the secondary winding shall be 100VA per phase with Class 1.0 3P accuracy to BS EN 61869-3:2011.

## 8.9 Small Wiring and Ancillary Equipment (refer to clause 1.5.4)

The following additional requirements are to be met: -

### 8.9.1 Auxiliary Switches

Auxiliary switches may be called for which will change position as a circuit breaker attains or departs from the service or earth locations on withdrawable equipment, or selectors attain or depart from the service or earth position on non-withdrawable equipment.

All auxiliary switches, whether they are in use or not, shall be wired up to a suitable terminal board on the fixed part of the switchgear such that they can easily be connected to multicore cables.

The use of auxiliary relays to substitute for inability to supply and connect sufficient auxiliary switches is strongly deprecated and is subject to approval by the Electricity North West Plant Policy Manager in each individual case.

#### 8.9.1.1 Standard provision of auxiliary switches in primary substations.

The minimum number of electrically separate auxiliary switches required is: -

##### a) Standard Feeder Units:

Open when CB open:	6
Closed when CB open:	9
Open when closing spring charged:	2
Closed when closing spring charged:	2

##### b) Incoming Transformers and Bus Section Units:

Open when CB open:	8
Closed when CB open:	11
Open when closing spring charged:	2
Closed when closing spring charged:	2

##### c) Bulk Supply Units:

Open when CB open:	12
Closed when CB open:	15
Open when closing spring charged:	2
Closed when closing spring charged:	2

### 8.9.2 Wire Looms and Terminal Blocks

Where practical, secondary protection and control wiring looms shall be run in trunking. Wire looms, bus wiring and terminal blocks shall not be located on the inside floor or roof of protection and control cabinets.

### 8.9.3 Pilot Wiring

All pilot wiring shall be insulated to 5kV.

## 8.10 Auxiliary Supplies

For the purpose of this specification, a nominal 110V battery and a 240V single-phase ac supply may be assumed as standard. The supplies to the switchgear will be as on the relevant Electricity North West Schematic Drawing provided under a separate Contract.

Motor wound spring charging supplies shall be fed from an 110V dc battery system with a maximum supply of 125V.

## **8.11 Manufacturers' Diagrams**

Diagrams shall be in accordance with any Electricity North West individual Contract requirements and additionally with any applicable Electricity North West standards. (Appendix B contains the complete list of Electricity North West standard diagrams.)

## **8.12 Gas (refer to clause 1.5.2)**

Equipment in which gas is used shall be supplied with:

- A pressure gauge or indicator.
- A two stage pressure switch.

## **9. ITEMS ADDITIONAL TO ENA TS 41-36**

### **9.1 Busbar Protection**

Busbar zone protection will generally be required and shall conform to either 9.1.1 or 9.1.2. Provision is to be made, where specified, for mounting and supply of frame-check or neutral check current transformers.

#### **9.1.1 *Earth Fault only with Frame Leakage Check***

This could be applied to any site.

Zone discrimination by one set of three current transformers on each unit. Bus section unit one set of three current transformers on each side for zone discrimination.

Separate bonding bar and true earth bar with circuit earthing to true earth bar.

One frame leakage check current transformer mounted on bus-section unit to connect the bonding bar to the true earth bar.



### 9.1.2 **Earth Fault only with Current Transformer Check**

This could be applicable to sites where the frame leakage check is not practicable.

Two sets of three current transformers per circuit. One for zone discrimination and one for overall check. Bus section unit: one set of three current transformers on each side for zone discrimination.

Auxiliary switches are required on each switchgear unit's earth switch to disconnect and short the check zone current transformers when circuit earth is selected. The performance shall be as below:

#### (a) Earth switch off

- 2 parallel contacts closed to connect check zone current transformers
- 1 check zone current transformer shorting contact open.

#### (b) Earth switch on

- 1 check zone current transformer shorting contact closed.
- 2 parallel check zone current transformer connecting contacts open.

### 9.1.3 **Frame leakage CT mounting**

The frame leakage current transformer shall normally be mounted on the bus-section unit.

### 9.1.4 **Earth Bonds and Connections**

On switchgear with frame-earth busbar-protection the frame bonding bar (uninsulated) shall be painted Grass Green and the true earth bar (insulated) shall not be painted. The construction shall be generally as ENA TS 41-36 section 1.5.3

## 9.2 **Busbar Protection Wiring**

The secondary wiring connections associated with the busbar protection equipment shall be kept entirely separate on both the panels and in the multi-core cable connections, both electrically and physically, so that there is no danger of accidental contact or induced current circulating in the busbar protection relay coils causing inadvertent operation. The relay and control panels are separately specified in Electricity North West Specification ES337 and will be the subject of a separate enquiry.

## 9.3 **Isolating Features of Secondary Circuits**

Where the secondary connections are broken when the circuit breaker is isolated / withdrawn, jumper connections shall be provided for completing these connections to permit testing.

## 9.4 **Secondary Wiring Disconnection**

Where the switchgear is demountable the appropriate secondary wiring shall be disconnected by means of suitable plugs and sockets of a design approved by Electricity North West. Means shall be provided to ensure and maintain full contact wipe.

## 9.5 Auto-reclosing

All switchgear shall be suitable for auto-reclosing duty.

## 9.6 Phasing out of Non-isolatable Units

Non-isolatable switchgear shall be supplied with a means for phasing out approved by the Electricity North West Plant Policy Manager. Tenderers should provide detailed procedures and any necessary equipment to allow for phasing out on non-isolatable units.

## 9.7 Trip Circuit Supervision

### 9.7.1 Scheme Required

The trip circuit supervision scheme shall be Scheme H7 of ENA Engineering Recommendation S15 and is shown on the relevant schematic diagram. The ohmic value of the resistor to be provided is indicated on the relevant Electricity North West drawing.

### 9.7.2 Label

Where the secondary circuit connections are taken through flexible trunking an additional label shall be fitted: -

WARNING  
REMOVAL OR REPLACEMENT OF THE PLUG BOX  
MAY OPERATE THE TRIP CIRCUIT FAIL ALARM

Where secondary circuit connections are opened when the circuit breaker is isolated the label shall read: -

WARNING  
ISOLATION FROM OR RESTORATION TO THE SERVICE  
LOCATION MAY OPERATE THE TRIP CIRCUIT FAIL ALARM

## 9.8 Control Scheme

The overall control, trip and alarm facilities are shown on the diagrams listed in Appendix B.

## 9.9 Selector Switches

Selector switch handle shapes shall comply with ENA TS 50-18, and be fitted with stud type connections. Loose connecting screws or pinch type terminals are not acceptable.

## 9.10 Circuit Breaker Interlocks

If key interlocks are to be used within the switchgear, interlocking shall be provided by a means of:

- Castell type FS (or equivalents) for mechanical locking and
- A combination of Lowe and Fletcher type H31 electrical and Castell type FS (or equivalents) mechanical key and locks for electrical locking.

## 9.11 Multicore Cables

No multicore/multi-pair cabling is included in this Contract. An undrilled removable gland plate capable of taking 25mm glands is to be provided at a position at least 150mm above floor level.

The routing of multicore cables to the switchgear shall not interfere with access to busbars or current transformer chambers.

## 9.12 Terminals and Terminal Blocks

Insertion clamp type terminals for current transformer wiring and Electricity North West multicores, labels, terminal covers and multicore terminal blocks shall comply with ENA TS 50-18. Terminals supplied for the termination of Electricity North West multicore cabling shall with the exception of Bus Zone wiring be Weidmuller WDU10SL or RSF1 or equivalent for current transformer circuitry and Weidmuller WDU6SL or RSF3 or equivalent for all other protection and control circuitry.

Terminals compliant with ENA TS 50-18 shall be supplied for the termination of the buszone panel CT multicore cabling, and shall be fitted with a linking arrangement in order that the bus zone CT circuitry can be manually shorted to earth.

## 9.13. Platforms and Ladders

Where required platforms and ladders shall be provided to give safe and easy access to all parts of the equipment, for operation, inspection and cleaning. The platforms shall, unless otherwise approved, be of the gridway type, and the ladders of glass fibre rungs.

Ladders used for normal operation on the switchgear shall comply with the requirements of Health and Safety Guidance Note GS.31.

Portable ladders shall be of glass fibre to BS 1129.

Provision shall be made for the use of fall arrest devices when it is necessary to work on top of the switchgear.

## 9.14 Lifting and handling facilities

### 9.14.1 General

Preference will be given to non-withdrawable designs of equipment and then to those which minimise manual handling and manoeuvring.

Where handling is required by design it shall be such that any withdrawable portion can be reasonably manoeuvred by one man.

The wheels shall be such that running on a concrete floor will not cause damage to the floor

### 9.14.2 Additional Equipment - Withdrawable Circuit Breakers

Where required a power operated device shall be provided for raising and lowering the circuit breaker. This may take the form of a portable device common to the whole switchboard, which can be manoeuvred by one man.

Such devices shall be stable in operation, with the minimum of exposed moving parts, and with a supply of 110V ac single phase or dc to be stated in the Schedule. 110V supplies will be provided by Electricity North West.

A safety device shall be provided to prevent damage due to over-winding.

#### **9.14.3 Voltage Transformers**

Voltage transformer assemblies shall be provided with suitable lifting attachments.

#### **9.14.4 Transport**

If additional bracing is required during transport this shall be painted in a distinctive colour and if necessary clearly lettered "Do not remove until housing firmly fixed to foundation".

#### **9.15 Telecontrol**

All switchgear shall be provided with telecontrol facilities.

#### **9.16 Labels**

In addition to or in place of any other indications:

- manual trip and close buttons shall be labelled "trip" and "close".
- SF<sub>6</sub> gas pressure gauges shall be labelled for the section of busbar or circuit breaker to which they relate.
- If the equipment has more than one gas chamber each chamber shall be clearly labelled with the mass of SF<sub>6</sub> gas in kilogram. If there is only one chamber the mass of gas shall be clearly identified on the front of the unit.
- Internal panel equipment including the rear side of the relays and test blocks shall be labelled. The labels shall be durable, non fading, permanently attached to the equipment and clearly visible.

## 10. DOCUMENTS REFERENCED

Health & Safety Guidance Note GS.31	Safe Use of Ladders, Step Ladders and Trestles
Health and Safety at Work Act 1974	
Control of Substances Hazardous to Health Regulations 1988	
Manual Handling Operations Regulations 1992	
Environmental Protection Act 1990	
Special Waste Regulations 1996	
Waste Management Licensing Regulations 1994	
Control of Pollution (Amendment) Act 1989	
ISO 9000	Quality Systems - Guide to Dependability Programme Management
BS EN 14001	Environmental Management Systems Specification with Guidance For Use
BS EN 61869-2:2012	Instrument Transformers. Additional Requirements for Current Transformers
BS EN 61869-3:2011	Instrument Transformers. Additional Requirements for Inductive Voltage Transformers
BS 1129	Specification for Portable Timber Ladders, Steps, Trestles and Lightweight Stagings
BS 4800	Schedule of Paint Colours for Building Purposes
BS 5227	Specification for AC Metal Enclosed Switchgear and Controlgear for Rated Voltages above 1kV up to and including 52kV
BS 50181	Specification of Plug-in type bushings above 1kV upto 52kV and from 250A to 2,50kA for equipment other than liquid filled transformers.
ENA TS 35-17	Class X Current Transformers
ENA TS 41-26	Distribution Switchgear for Service up to 36kV (cable connected)
ENA TS 41-36	Distribution Switchgear for Service up to 36kV (cable and overhead conductor connected)
ENA TS 50-18	Design and Application of Ancillary Electrical Equipment
Engineering Recommendation S15 Standard Schematic Diagrams	
ES336	Interposing Transformers for Telecontrol Current and Voltage Measurement
ES337	Specification for 19" Rack Control and Relay Panels for Use in BSP and Primary Substations

**11. KEYWORDS**

33kV; CT; Indoor; Protection; Switchgear; VT

## APPENDIX A

### SCHEDULE A - SECTION 1

#### PROTECTION AND CONTROL RELAY REQUIREMENTS (OPTION 1)

The following schedule refers, per scheme, to protection and control relays that are currently employed on 33kV fixed pattern indoor cable connected switchgear on Electricity North West networks. The use of relays supplied by other manufacturers may be considered. However prior approval shall be obtained from the Electricity North West Protection Policy Manager for relays not officially approved for use on Electricity North West networks. Protection relays offered as part of this Tender shall have received a notice of conformity issued by the Energy Networks Association protection assessment panel and be listed with in Electricity North West document EPD307.

#### 1. 33kV FEEDER WITH TRANSLAY AND INTERTRIPPING.

- (OPTION A) ALSTOM MHOB04 Translay unit protection relay.
- (OPTION A) ALSTOM MCRI01 Guard relay for use with MHOB04 Translay relay.
- (OPTION B) Toshiba GRL 150 Unit Protection Relay.
- Siemens Protection Devices 7SR11 (Argus C) 110VDC O/C and E/F relay. Relay to be provided with ESI-1 resistors for use on all 110VDC binary inputs.
- (OPTION A) Schneider Electric Gayrad GCM05 Intertripping relay.
- Siemens Protection Devices 2RMLG01 test blocks (2off).
- Siemens Protection Devices XR350 trip circuit supervision relay and resistors.
- Siemens Protection Devices TR212 busbar protection auxiliary Relay.
- Siemens Protection Devices TR243 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500Ω coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500Ω coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima spring release aux relay with magnetic blow out contacts, following flag and test button. Spring release aux relay only required for circuits with DAR where large current are drawn by closing circuit.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336
- ALSTOM Prima Busbar fault aux relay, following flag and test button.

#### 2. 33kV FEEDER WITH TEED TRANSLAY AND INTERTRIPPING.

- ALSTOM MHOA04 Teed Translay unit protection relay
- Quadrature CT for MHOA04 relay for teed connected pilots

- ALSTOM MCRI01 Guard relay for use with MHOA04 Translay relay.
- Siemens Protection Devices 7SR11 (Argus C) 110VDC O/C and E/F relay. Relay to be provided with ESI-1 resistors for use on all 110VDC binary inputs.
- Schneider Electric Gayrad GCM05 Intertripping relay.
- Siemens Protection Devices 2RMLG01 test blocks (2off).
- Siemens Protection Devices XR350 trip circuit supervision relay and resistors.
- Siemens Protection Devices TR212 Busbar Protection auxiliary relay.
- Siemens Protection Devices TR243 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSOTM Prima 500Ω coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500Ω coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima spring release aux. relay with magnetic blow out contacts, following flag and test button. Spring release aux relay only required for circuits with DAR where large current are drawn by closing circuit.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336
- ALSOTM Prima Busbar fault aux relay, following flag and test button.

### **3. 33kV TRANSFORMER WITH HV/LV ADJACENT.**

- Siemens Protection Devices 5B3 Balanced earth fault relay with metrosil and 1000Ω variable stabilising resistor.
- Siemens Protection Devices 7SR11 (Argus C) 110VDC O/C, HSOC and E/F relay. Relay to be provided with ESI-1 resistors for use on all 110VDC binary inputs
- Siemens Protection Devices 2RMLG01 test blocks (2off).
- Siemens Protection Devices XR350 trip circuit supervision relay and resistors.
- Siemens Protection Devices TR212 busbar protection auxiliary relay.
- Siemens Protection Devices TR243 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500Ω coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500Ω coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.



- ALSTOM Prima spring release aux relay with magnetic blow out contacts, following flag and test button. Spring release aux relay only required for circuits with DAR where large current are drawn by closing circuit.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336
- ALSTOM Prima Busbar fault aux Relay with following flag and test button.

#### **4. 33kV TRANSFORMER FEEDER WITHOUT PILOTS, WITH AUTO RECLOSE.**

- Siemens Protection Devices 5B3 Balanced earth fault relay with metrosil and 1000  $\Omega$  stabilising resistor.
- Siemens Protection Devices 7SR210 (Argus M) 110VDC O/C and E/F and Auto Reclose relay. Relay to be provided with ESI-1 resistors for use on all 110VDC binary inputs.
- Siemens Protection Devices 2RMLG01 test blocks (2off).
- Siemens Protection Devices XR350 trip circuit supervision relay and resistors.
- Siemens Protection Devices TR212 busbar Protection auxiliary relay.
- Siemens Protection Devices TR243 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500 $\Omega$  coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500 $\Omega$  coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima spring release aux. relay with magnetic blow out contacts, following flag and test button. Spring release aux relay only required for circuits with DAR where large current are drawn by closing circuit.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336
- ALSTOM Prima Busbar fault aux relay, following flag and test button.
- ALSTOM Prima 500 $\Omega$  coil Bi-stable telecontrol DAR IN/OUT interposing relay with following flag and test button.

#### **5. 33kV TRANSFORMER FEEDER WITH INTERTRIPPING.**

- Siemens Protection Devices 5B3 Balanced earth fault relay with metrosil and 1000  $\Omega$  stabilising resistor.
- Siemens Protection Devices 7SR11 (Argus C) 110VDC O/C, HSOC and E/F relay. Relay to be provided with ESI-1 resistors for use on all 110VDC binary inputs
- Schneider Electric Gayrad GCM05 Intertripping relay.

- Siemens Protection Devices 2RMLG01 test blocks (2off).
- Siemens Protection Devices XR350 trip circuit supervision relay and resistors.
- Siemens Protection Devices TR212 busbar protection auxiliary relay.
- Siemens Protection Devices TR243 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500Ω coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500Ω coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima spring release aux relay with magnetic blow out contacts, following flag and test button. Spring release aux relay only required for circuits with DAR where large current are drawn by closing circuit.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336
- ALSTOM Prima Busbar fault aux relay, following flag and test button.

#### **6. 33kV TRANSFORMER FEEDER WITH AUTO RECLOSE AND INTERTRIPPING.**

- Siemens Protection Devices 5B3 Balanced earth fault relay with metrosil and 1000 Ω stabilising resistor.
- Siemens Protection Devices 7SR210 (Argus M) 110VDC O/C and E/F and Auto Reclose relay. Relay to be provided with ESI-1 resistors for use on all 110VDC binary inputs.
- Schneider Electric Gayrad GCM05 Intertripping relay.
- Siemens Protection Devices 2RMLG01 test blocks (2off).
- Siemens Protection Devices XR350 trip circuit supervision relay and resistors.
- Siemens Protection Devices TR212 busbar Protection auxiliary relay.
- Siemens Protection Devices TR243 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500Ω coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500Ω coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima spring release aux. relay with magnetic blow out contacts, following flag and test button. Spring release aux relay only required for circuits with DAR where large current are drawn by closing circuit.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336

- ALSTOM Prima Busbar fault aux relay, following flag and test button.
- ALSTOM Prima 500Ω coil Bi-stable telecontrol DAR IN/OUT interposing relay with following flag and test button.

#### 7. 33kV BUS SECTION.

- Siemens Protection Devices 7SR11 (Argus C) 110VDC O/C and E/F relay. Relay to be provided with ESI-1 resistors for use on all 110VDC binary inputs (**if requested**)
- Siemens Protection Devices 2RMLG01 test block. (If requested)
- Siemens Protection Devices XR350 trip circuit supervision relay.
- Siemens Protection Devices TR212 busbar protection auxiliary relay
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500Ω coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500Ω coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336
- Ammeter (**if no protection is specified**)

#### 8. 33kV OVERHEAD RADIAL FEEDER WITH AUTO RECLOSE AND DISTANCE PROTECTION.

- Siemens Protection Devices Ohmega 315 110V dc distance protection relay with integrated auto reclose and overcurrent guard functionality. Relay to be provided with ESI-1 resistors for use on all 110VDC binary inputs
- Siemens Protection Devices 7SR11 (Argus C) 110VDC O/C and E/F relay. Relay to be provided with ESI-1 resistors for use on all 110VDC binary inputs.
- Siemens Protection Devices 2RMLG01 test blocks (2off).
- Crompton phase unbalance relay type 252 Series.
- Siemens Protection Devices XR350 trip circuit supervision relay and resistors.
- Siemens Protection Devices TR212 busbar protection auxiliary relay.
- Siemens Protection Devices TR243 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500Ω coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500Ω coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.

- ALSTOM Prima spring release aux. relay with magnetic blow out contacts, following flag and test button. Spring release aux relay only required for circuits with DAR where large current are drawn by closing circuit.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336
- ALSTOM Prima Busbar fault aux Relay with, following flag and test button.
- ALSTOM Prima 500Ω coil telecontrol DAR IN interposing relay with following flag and test button.
- ALSTOM Prima 500Ω coil telecontrol DAR OUT interposing relay with following flag and test button.
- ALSTOM Prima time delay on pick up aux relay with following flag and test button to be used with the Crompton 252 Series phase unbalance relay.

**9. 33kV OVERHEAD RING FEEDER WITH AUTO RECLOSE AND DISTANCE PROTECTION.**

- Siemens Protection Devices Ohmega 315 110V dc distance protection relay with integrated auto reclose and overcurrent guard functionality. Relay to be provided with ESI-1 resistors for use on all 110VDC binary inputs
- Siemens Protection Devices 7SR220 (Argus M) directional O/C and E/F relay. Relay to be provided with ESI-1 resistors for use on all 110VDC binary inputs.
- Siemens Protection Devices 2RMLG01 test blocks (2off).
- Crompton phase unbalance relay type 252 Series.
- Siemens Protection Devices XR350 trip circuit supervision relay and resistors.
- Siemens Protection Devices TR212 busbar protection auxiliary relay.
- Siemens Protection Devices TR243 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500Ω coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500Ω coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima spring release aux. relay with magnetic blow out contacts, following flag and test button. Spring release aux relay only required for circuits with DAR where large current are drawn by closing circuit.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336
- ALSTOM Prima Busbar fault aux Relay with following flag and test button.
- ALSTOM Prima 500Ω coil telecontrol DAR IN interposing relay with following flag and test button.

- ALSTOM Prima 500Ω coil telecontrol DAR OUT interposing relay with following flag and test button.
- ALSTOM Prima time delay on pick up aux relay with following flag and test button to be used with the Crompton 252 Series phase unbalance relay.

#### **10. 33kV INCOMING TRANSFORMER UNIT**

- Relays to be provided separately as per section 7.1
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336 (2off)
- Interposing VT for telecontrol to Electricity North West Specification (ES) 336
- ALSTOM ISTAT500 MW/MVar transducer to Electricity North West Specification (ES) 335
- Anti pumping relay to suit manufacturer.
- Proof of earthing interlock key as detailed in section 9.10 (match to existing system).

## SCHEDULE A - SECTION 1

### PROTECTION AND CONTROL RELAY REQUIREMENTS (OPTION 2)

The following schedule refers, per scheme, to protection and control relays that are currently employed on 33kV fixed pattern indoor cable connected switchgear on Electricity North West' networks. The use of relays supplied by other manufacturers may be considered.. However prior approval shall be obtained from the Electricity North West Protection Policy Manager for relays not officially approved for use on Electricity North West networks. Protection relays offered as part of this Tender shall have received a notice of conformity issued by the Energy Networks Association protection assessment panel.

#### 1. 33kV FEEDER WITH TRANSLAY AND INTERTRIPPING.

- (OPTION A) ALSTOM MHOB04 Translay unit protection relay.
- (OPTION A) ALSTOM MCRI01 Guard relay for use with MHOB04 Translay relay.
- (OPTION B) Toshiba GRL 150 Unit Protection Relay.
- ALSTOM Micom P14N 110VDC O/C and E/F relay.
- (OPTION A) Schneider Gayrad GCM05 intertripping relay.
- ALSTOM MMLG01 test blocks (2 off).
- ALSTOM MVAX31 trip circuit supervision relay and resistor.
- ALSTOM MVAJ21 busbar protection auxiliary relay.
- ALSTOM MVAJ28 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500ohm coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500ohm coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM PRIMA spring release aux relay with magnetic blow out contacts following flag and test button.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336.
- ALSTOM Prima busbar fault aux. Relay.

#### 2. 33kV FEEDER WITH TEED TRANSLAY AND INTERTRIPPING.

- ALSTOM MHOA Translay unit protection relay and Quadrature CT.
- ALSTOM MCRI01 Guard relay for use with MHOA04 Translay relay.

- ALSTOM Micom P14N 110VDC O/C and E/F relay.
- Schneider Gayrad GCM05 intertripping relay.
- ALSTOM MMLG01 test blocks (2 off).
- ALSTOM MVAX31 trip circuit supervision relay and resistor.
- ALSTOM MVAJ21 busbar protection auxiliary relay.
- ALSTOM MVAJ28 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500ohm coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500ohm coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM PRIMA spring release aux relay with magnetic blow out contacts following flag and test button.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336.
- ALSTOM Prima busbar fault aux. Relay.

### **3. 33kV TRANSFORMER WITH HV/LV ADJACENT.**

- ALSTOM MFAC14 balanced earth fault relay with metrosil and 1000Ω stabilising resistor.
- ALSTOM Micom P14N 110VDC HS, O/C and E/F relay.
- ALSTOM MMLG01 test blocks (2 off).
- ALSTOM MVAX31 trip circuit supervision relay and resistor.
- ALSTOM MVAJ21 busbar protection auxiliary relay.
- ALSTOM MVAJ28 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500ohm coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500ohm coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM PRIMA spring release aux relay with magnetic blow out contacts following flag and test button.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336.
- ALSTOM Prima busbar fault aux. Relay.

#### 4. 33kV TRANSFORMER WITHOUT PILOTS, WITH AUTO RECLOSE.

- ALSTOM MFAC14 balanced earth fault relay with metrosil and 1000Ω stabilising resistor.
- ALSTOM Micom P14N 110VDC HS, O/C and E/F with auto-reclose relay.
- ALSTOM MMLG01 test blocks (2 off).
- ALSTOM MVAX31 trip circuit supervision relay and resistor.
- ALSTOM MVAJ21 busbar protection auxiliary relay.
- ALSTOM MVAJ28 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500ohm coil telecontrol trip aux. relay with magnetic blow out contacts.
- ALSTOM Prima 500ohm coil telecontrol close aux. relay with magnetic blow out contacts.
- ALSTOM Prima 500ohm coil telecontrol auto-reclose IN/OUT aux. relay with magnetic blow out contacts.
- ALSTOM PRIMA spring release aux relay with magnetic blow out contacts, following flag and test button.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336.
- ALSTOM Prima busbar fault aux. Relay.

#### 5. 33kV TRANSFORMER FEEDER WITH INTERTRIPPING.

- ALSTOM MFAC14 balanced earth fault relay with metrosil and 1000Ω stabilising resistor.
- ALSTOM Micom P14N 110VDC HS, O/C and E/F relay.
- ALSTOM MMLG01 test blocks (2 off).
- Schneider Gayrad GCM05 intertripping relay.
- ALSTOM MVAX31 trip circuit supervision relay and resistor.
- ALSTOM MVAJ21 busbar protection auxiliary relay.
- ALSTOM MVAJ28 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.



- ALSTOM Prima 500ohm coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500ohm coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM PRIMA spring release aux relay with magnetic blow out contacts , following flag and test button.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336.
- ALSTOM Prima busbar fault aux. Relay.

#### **6. 33kV TRANSFORMER WITH AUTO RECLOSE AND DISTANCE PROTECTION.**

- ALSTOM Micom P443 110VDC distance protection relay with integrated auto reclose and overcurrent guard functionality.
- ALSTOM Micom P14N 110VDC HS, O/C and E/F with auto-reclose relay.
- Schneider Gayrad GCM05 intertripping relay.
- ALSTOM MMLG01 test blocks (2 off).
- ALSTOM MVAX31 trip circuit supervision relay and resistor.
- ALSTOM MVAJ21 busbar protection auxiliary relay.
- ALSTOM MVAJ28 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500ohm coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500ohm coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM PRIMA spring release aux relay with magnetic blow out contacts following flag and test button.
- ALSTOM Prima 500ohm coil telecontrol auto-reclose IN/OUT aux relay with magnetic blow out contacts, following flag and test button.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336.
- ALSTOM Prima busbar fault aux. Relay.

## 7. 33kV BUS SECTION.

- ALSTOM Micom P14N O/C and E/F relay (if requested).
- ALSTOM MMLG01 test blocks (if requested).
- ALSTOM MVAX31 trip circuit supervision relay and resistor.
- ALSTOM MVAJ21 busbar protection auxiliary relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500ohm coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500ohm coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM PRIMA spring release aux relay with magnetic blow out contacts following flag and test button.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336.

## 8. 33kV OVERHEAD RADIAL FEEDER WITH AUTO RECLOSE AND DISTANCE PROTECTION.

- ALSTOM Micom P443 110VDC distance protection relay with integrated auto reclose and overcurrent guard functionality.
- ALSTOM Micom P14N 110VDC O/C and E/F with auto-reclose relay.
- ALSTOM MMLG01 test blocks (2 off).
- Crompton phase unbalance relay type 252 Series.
- ALSTOM MVAX31 trip circuit supervision relay and resistor.
- ALSTOM MVAJ21 busbar protection auxiliary relay.
- ALSTOM MVAJ28 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500ohm coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500ohm coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM PRIMA spring release aux relay with magnetic blow out contacts following flag and test button.
- ALSTOM Prima 500ohm coil telecontrol auto-reclose IN aux. relay with magnetic blow out contacts, following flag and test button.

- ALSTOM Prima 500ohm coil telecontrol auto-reclose OUT aux. relay with magnetic blow out contacts, following flag and test button.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336.
- ALSTOM Prima busbar fault aux. Relay.
- ALSTOM Prima time delay on pickup aux. relay to be used with the Crompton 252 series phase unbalance relay.

**9. 33kV OVERHEAD RING FEEDER WITH AUTO RECLOSE AND DISTANCE PROTECTION.**

- ALSTOM Micom P443 110VDC distance protection relay with integrated auto reclose and overcurrent guard functionality.
- ALSTOM Micom P14N 110VDC DOC and E/F with auto-reclose relay.
- ALSTOM MMLG01 test blocks (2 off).
- Crompton phase unbalance relay type 252 Series.
- ALSTOM MVAX31 trip circuit supervision relay and resistor.
- ALSTOM MVAJ21 busbar protection auxiliary relay.
- ALSTOM MVAJ28 electrical reset tripping relay.
- Anti pumping relay to suit manufacturer.
- ALSTOM Prima 500ohm coil telecontrol trip aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM Prima 500ohm coil telecontrol close aux relay with magnetic blow out contacts, following flag and test button.
- ALSTOM PRIMA spring release aux relay with magnetic blow out contacts following flag and test button.
- ALSTOM Prima 500ohm coil telecontrol auto-reclose IN aux. relay with magnetic blow out contacts.
- ALSTOM Prima 500ohm coil telecontrol auto-reclose OUT aux. relay with magnetic blow out contacts.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336.
- ALSTOM Prima busbar fault aux. Relay.
- ALSTOM Prima time delay on pickup aux. relay to be used with the Crompton 252 series phase unbalanced relay.

## 10. 33kV INCOMING TRANSFORMER UNIT

- Relays to be provided separately as per section 7.1.
- Wedding ring type interposing CT for telecontrol to Electricity North West Specification (ES) 336.
- Interposing VT for telecontrol to Electricity North West Specification (ES) 336.
- ALSTOM ISTAT500 MW/MVar transducer to Electricity North West Specification (ES) 335.
- Anti pumping relay to suit manufacturer.
- Proof of earthing interlock key as detailed in section 9.10 (match to existing system).

## SCHEDULE A - SECTION 2

### REQUIREMENTS AND GENERAL PARTICULARS

#### BASIC UNITS

#### 800A BUSBAR GEAR

##### 1. FEEDER UNIT

Busbar rating 800A.

Circuit breaker, three pole, 800A, 36kV with specified short circuit rating, locally and remotely electrically controlled and fitted with: -

- Shunt trip coil, 110V dc.
- Motorwound spring closing mechanism 110V dc.
- Auxiliary switches:
  - open when CB open - 6 minimum
  - closed when CB open - 9 minimum
- 1 - Trip healthy resistor.
- Set of three current transformers (CT01), for operating main protection.
- Set of three current transformers (CT02), for operating back-up and indicating ammeters.
- Set of three current transformers (CT03), for operating busbar protection. Accommodation shall be available for a second set of current transformers if specified.
- Dry type terminations for three single-core XLPE or EPR cables up to 630mm<sup>2</sup> conductor.
- Voltage transformer in accordance with section 8.8 where required for operating distance protection.
- Provision shall be made for earthing to the true earth of an earth link for the cable sheath, this link to be supplied on a separate Contract and mounted below the cable box by Electricity North West.
- Set of multicore cable glands.
- CB control switch with padlocking facilities.
- Selector switch "Local/Remote" with padlocking facilities.
- Supporting structure complete with earth bars, circuit and busbar earthing contacts, interlocks, labels, terminal boards, small wiring, fuses and if applicable, raising and lowering devices etc.

## 2. OUTGOING TRANSFORMER UNITS

2(a) 33/11kV or 6.6kV 23MVA transformer units

As feeder unit.

2(b) 33/6.6kV 38MVA transformer units

As feeder unit.

## 3. BUS SECTION UNIT

Sections of busbar, 800A, to join the bus-section circuit breaker to the units on each side, such that access from front to rear of the switchboard is possible on one side of the bus-section unit.

Circuit breaker, three pole, 800A, 36kV with specified short circuit rating, locally and remotely electrically controlled and fitted with:-

- Shunt trip coil, 110V dc.
- Motor wound spring closing mechanism 110V dc.
- Auxiliary switches:
  - open when CB open - 6 minimum
  - closed when CB open - 9 minimum
- Trip healthy resistor
- One current transformer (CTM1), for operation of ammeter.
- Two sets of accommodation, mounting and small wiring for bus zone protection current transformers (CT04), one set on each side of the circuit breaker.
- Accommodation for one frame leakage current transformer, where specified.
- Set of multicore glands.
- CB control switch with padlocking facilities.
- Selector switch "Local/Remote" with padlocking facilities.
- Supporting structure complete with earth bars, left and right hand busbar earthing contacts, interlocks, labels, terminal boards, small wiring, fuses and, if applicable, raising and lowering device etc.

## 2000A BUSBAR GEAR

### 4. FEEDER UNIT

As Item 1, but with 2000A busbars.

## 5. OUTGOING TRANSFORMER UNITS

As Item 2(a) 2(b), but with 2000A busbars.

## 6. BUS-SECTION UNIT

As Item 3, but with 2000A busbars, circuit-breaker, with an ammeter current transformer and two normally open and two normally closed auxiliary switches operated by an isolating mechanism. On units with busbar disconnectors on both sides of a non-isolatable circuit breaker, both disconnectors shall have two normally open and two normally closed auxiliary switches.

## 7. INCOMING TRANSFORMER UNIT

### 7.1 *With Cable Box*

Section of busbars 2000A.

Circuit breaker, three pole, 2000A, 36kV, with specified short circuit rating, locally and remotely electrically controlled and fitted with:-

- Shunt trip coil, 110V dc.
- Motor wound spring closing mechanism 110V dc.
- Auxiliary switches:
  - open when cb open - 11
  - closed when cb open - 11
- Trip healthy resistor.
- Set of three current transformers (CT05) for operating main protection.
- Set of three current transformers (CT05) for operating back-up protection and instruments.
- Set of two current transformers for tariff metering, mounted on red and blue phases.
- One current transformer (CT11) for operating automatic voltage control, mounted on centre phase.
- Accommodation for two sets of three current transformers (CT04) for operating busbar protection, as specified.
- Voltage transformers as section 8.8.
- Dry type terminations for three single-core EPR or XLPE cables per phase. The island insulation shall be suitable for 10kV dc testing.
- Size and number of cables will be listed in Schedule B.
- CB control switch with padlocking facilities.

- Selector switch "Local/Remote" with padlocking facilities.
- Castell/Fortress lock for interlocking with 132kV switchgear.
- Four normally open and four normally closed auxiliary switches operated by the isolating mechanism when in the 'service' location.
- Supporting structure complete with earth bars, circuit and busbar earth contacts, interlocks, labels, terminal boards, small wiring, fuses and, if applicable, raising and lowering device etc.

## **7.2 Direct Connection**

As Item 7.1, but for the cable box substitute:-

Three phase set of through wall bushings, 2000A, with insulated connection chamber to switch unit.



**SCHEDULE B**

**GENERAL REQUIREMENTS (TO BE COMPLETED BY ELECTRICITY NORTH WEST)**

1	Substation name	
2	Number of units	
3	Operating mechanism	110V dc motor wound spring
4	Shunt trip coil	110V dc
5	Spring release coil	110V dc
6	Busbar rating (A)	
7	(a) Number of Incoming Transformer units:	
	(b) Current rating (A)	
8	(a) Number of feeder units	
	(b) Current rating (A)	
9	Number of outgoing transformer or feeder/transformer units:	
	Current rating (A)	
10	Number of bus-section units	
	Current rating (A)	
11	Number of skeleton units	
	Current rating (A)	
12	Foundations to accommodate expected number of units	
13	Date for delivery to site	
14	Date for completion of erection	
15	Date for commissioning	

**SCHEDULE C**

**SWITCHBOARD ARRANGEMENT (TO BE COMPLETED BY ELECTRICITY NORTH WEST)**

Substation Name	
--------------------	--

Front Left

Panel No	Circuit Title
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Front Right





## APPENDIX B

### STANDARD SCHEMATIC DRAWINGS

The drawings listed below relate to 33Kv fixed pattern switchgear, and should be regarded as basic standards although the Asset Policy & Standards Manager may agree to minor modifications.

For other Protection and Control drawings, please refer to Electricity North West Specification ES337

Note: Only the diagrams for the 33kV switchgear will be issued with the Tender. If any other diagrams are required they must be requested from the Procurement Department of Electricity North West.

DRAWING NUMBERS			SCHEME DESCRIPTION
Number	Rev	Date	
900440-001	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV Bus-Sections
900240-002	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV Feeder with Teed Translay (Siemens)
900440-003	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV Transformer with Banked Translay (Siemens)
900440-004	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV Translay and Transformer Feeders (Siemens)
900440-005	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV Translay Feeder with Banked Transformer (Siemens)
900440-006	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV Radial Distance Protection feeder (Siemens)
900440-007	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV Ring Circuit Distance Protection (Siemens)
900440-008	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV Transformer with Translay 'S' MBCI (Siemens)
900440-009	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV Transformer with HV/LV Adjacent (Siemens)
900440-010	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV Transformer Feeder without Pilots with Auto-reclose (Siemens)
900440-011	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV Transformer Feeder with intertripping (Siemens)
900440-012	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV O/H Ring Feeder with DAR & Distance Protection (Siemens)
900440-013	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV O/H Radial Feeder with DAR & Distance Protection (Siemens)
900440-014	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV Feeder with Translay & Intertripping (Siemens)
900440-015	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & indications for 33kV Transformer Feeder with DAR & Distance Protection (Siemens)
900440-016	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications

DRAWING NUMBERS			SCHEME DESCRIPTION
			for Bus-Sections (Siemens)
900440-017	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV Feeder with Teed Translay & Intertripping (Siemens)
900440-018	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Control for 33kV Feeder with Toshiba GRL-150 Unit & Intertripping (Siemens)
900440-019	001	13/05/2013	Standard Circuit Diagram of Control & Indications for 33kV Transformer Feeders
900440-020	001	13/05/2013	Standard Circuit Diagram of Control & Indications for 33kV Feeders
900440-021	001	13/05/2013	Standard Circuit Diagram of Control & Indications for Bus-Sections
900440-022	001	13/05/2013	Standard Circuit Diagram of Control & Indications for Grid Units
900440-023	001	13/05/2013	Standard Diagram of CT & VT Connections for 33kV Fixed Pattern Switchgear Grid Transformer Incomers
900440-024	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for Remote 33kV Connections Teed and Banked Transformers
900440-025	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV VT Selection Scheme
900440-026	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV (Micom)
900440-027	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV (Micom)
900440-028	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV (Micom)
900440-029	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV (Micom)
900440-030	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV (Micom)
900440-031	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV (Micom)
900440-032	001	13/05/2013	Standard Circuit Diagram of CT & VT Connections for 33kV Feeder with Translay 'S' MBCI (Micom)
900440-033	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV Transformer with HV/LV Adjacent (Micom)
900440-034	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV Transformer Feeder without Pilots with Auto-reclose (Micom)
900440-035	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV Transformer Feeder with Intertripping (Micom)
900440-036	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV O/H Ring Feeder with Auto-reclose & Distance Protection (Micom)
900440-037	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV O/H Radial Feeder with Auto-reclose & Distance Prot (Micom)
900440-038	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV Feeder with Translay & Intertripping (Micom)
900440-039	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV Transformer Feeder with Auto-reclose & Intertripping (Micom)
900440-040	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications

DRAWING NUMBERS			SCHEME DESCRIPTION
			for 33kV Feeder with Teed Translay & Intertripping (Micom)
900440-041	001	13/05/2013	Standard Circuit Diagram of Protection, Alarms & Indications for 33kV Feeder with Translay 'S' MBCI & Intertripping (Micom)

**Historical Standard Drawings listed below for reference**

DRAWING NUMBERS			SCHEME DESCRIPTION
Number	Rev	Date	
900200-233	001	19/04/2005	Standard Circuit Diagram of CT and VT Connections for 33kV Fixed Pattern Switchgear - Bus Sections (Sheet 1 of 9)
900200-234	002	19/04/2005	Standard Circuit Diagram of CT and VT Connections for 33kV Fixed Pattern Switchgear – Feeder with Teed Translay (Sheet 2 of 9)
900200-235	002	19/04/2005	Standard Circuit Diagram of CT and VT Connections for 33kV Fixed Pattern Switchgear – Radial Feeder with Distance Protection (Sheet 3 of 9)
900200-236	002	19/04/2005	Standard Circuit Diagram of CT and VT Connections for 33kV Fixed Pattern Switchgear – Ring Circuit with Distance Protection (Sheet 4 of 9)
900200-237	001	19/04/2005	Standard Circuit Diagram of CT and VT Connections for 33kV Fixed Pattern Switchgear – VT Selection Scheme (Sheet 5 of 9)
900200/238	002	19/04/2005	Standard Circuit Diagram of CT and VT Connections for 33kV Fixed Pattern Switchgear – Feeder and Transformer Feeder (Sheet 6 of 9)
900200/239	002	19/04/2005	Standard Circuit Diagram of CT and VT Connections for 33kV Fixed Pattern Switchgear – Transformer with Banked Feeder. Slipover CT's on Transformer Leg. (Sheet 7 of 9)
900200/240	002	19/04/2005	Standard Circuit Diagram of CT and VT Connections for 33kV Fixed Pattern Switchgear – Transformer with Banked Feeder. Slipover CT's on Feeder Leg. (Sheet 8 of 9)
900200/241	002	19/04/2005	Standard Circuit Diagram of CT and VT Connections for 33kV Fixed Pattern Switchgear – 33kV Slipover CT's for Looped in Feeder Transformer, 33kV Slipover CT's for Teed Feeder Transformer & 33kV Neutral Voltage Displacement for Transformer Fed from Overhead Line without Pilots (Sheet 8 of 9)
900200/242	001	19/04/2005	Standard Circuit Diagram of Control and Indications for 33kV Transformer Feeder.
900200/243	001	19/04/2005	Standard Circuit Diagram of Control and Indications for 33kV Feeders.
900200/244	001	20/04/2005	Standard Circuit Diagram of Control and Indications for Bus Sections.
900200/245	002	20/04/2005	Standard Circuit Diagram of Protection, Alarms and Indications for 33kV Feeder with Translay and Intertripping.

DRAWING NUMBERS			SCHEME DESCRIPTION
900200/246	002	20/04/2005	Standard Circuit Diagram of Protection, Alarms and Indications for 33kV Feeder with Teed Translay and Intertripping.
900200/247	002	20/04/2005	Standard Circuit Diagram of Protection, Alarms and Indication for 33kV Transformer with HV/LV Adjacent.
900200/248	002	20/04/2005	Standard Circuit Diagram of Protection, Alarms and Indications for 33kV Transformer Feeder without Pilots, with Auto Reclose.
900200/249	002	20/04/2005	Standard Circuit Diagram of Protection, Alarms and Indications for 33kV Transformer Feeder with Intertripping.
900200/250	002	20/04/2005	Standard Circuit Diagram of Protection, Alarms and Indication for 33kV Transformer Feeder with Auto Reclose and Intertripping.
900200/251	001	20/04/2005	Standard Circuit Diagram of Protection, Alarms and Indication for 33kV Bus Sections.
900200/252	002	20/04/2005	Standard Circuit Diagram of Protection, Alarms and Indications for 33kV O/H Radial Feeder with Auto Reclose and Distance Protection.
900200/253	002	20/04/2005	Standard Circuit Diagram of Protection, Alarms and Indications for 33kV O/H Ring Feeder with Auto Reclose and Distance Protection.
900200/254	002	20/04/2005	Standard Circuit Diagram of Alarms and Indications for Grid Units.



**APPENDIX C**

**DRAWING SCHEDULE**

**33KV SWITCHGEAR DRAWING SCHEDULE**

<b>Drawings</b>	<b>With Tender</b>	<b>Preliminary. Number of Weeks after Order.</b>	<b>Final. Number of Weeks after Order.</b>
Switchboard General Arrangement – Project Specific <i>Dimensioned board layout including details of the operating mechanisms and front mimic diagrams.</i>	Most complicated circuit type to be provided with Tender	-	12
Civil Interface Drawing – Project Specific <i>Fully dimensioned plan and side elevation of switchgear showing –</i> <ul style="list-style-type: none"> <li>• <i>Alignment profiles and floor openings</i></li> <li>• <i>Fixing points and details</i></li> <li>• <i>Weights and loads</i></li> <li>• <i>Floor tolerances</i></li> <li>• <i>Minimum clearances</i></li> </ul>	Typical	-	12
Single Line Diagram – Project Specific <i>Showing -</i> <ul style="list-style-type: none"> <li>• <i>CTs</i></li> <li>• <i>VTs</i></li> <li>• <i>Circuit Breakers, Disconnectors and Earth Switches</i></li> <li>• <i>Cable connection details</i></li> <li>• <i>Circuit Live Test Points</i></li> <li>• <i>Table of all CTs and VTs giving number, ratio, type, class, VA, VKp, Rct, Im, Ith, voltage factor as required.</i></li> </ul>	Typical	8	12
Panel Internal and External General Arrangement / Layout. <i>Showing –</i> <ul style="list-style-type: none"> <li>• <i>Relay types, sizes and locations</i></li> <li>• <i>Door cut outs</i></li> <li>• <i>Terminal blocks</i></li> <li>• <i>Resistors and Metrosils</i></li> <li>• <i>Switches</i></li> <li>• <i>Indicating lamps</i></li> </ul>	Most complicated circuit type to be provided with Tender.	-	12

Gas Chamber Diagram <i>Showing -</i> <ul style="list-style-type: none"> <li>• Valve details</li> <li>• SF6 monitors</li> <li>• Pressure relief devices</li> <li>• Pressure Transmitters</li> <li>• Gas Zones</li> </ul>	Typical	-	12
AC and DC Schematics / Circuit Diagrams.	Most complicated circuit type to be provided with Tender.	12	16
Electrical Interlocking Drawing. Project Specific.	Typical	12	16
Wiring Diagrams <i>With enough information to allow point to point wiring checks to be carried out.</i>	Typical	12	16
Buswiring Diagram.	Typical	-	16
CT Mag Curves	-	-	20
Erection & Commissioning and Operation & Maintenance Manuals	Typical	-	26

## GENERAL NOTES

- 1 The above list is not exhaustive; the Contractor (switchgear manufacturer) shall provide all drawings and information that is required to fully understand the switchboard design.
- 2 The above dates include 2 weeks for Electricity North West to comment on and approve drawings.
- 3 Common cubicle numbering system to be used on all drawings. Refer to Electricity North West key line diagram for cubicle numbers.
- 4 As constructed drawings shall be provided 6 weeks after the mark-ups are submitted to the Contractor (switchgear manufacturer).

## NOTES ON DRAWINGS AND DRAWING FORMAT

- (a) Orthographic drawings shall use metric units and be reproduced to a scale that is declared on each print. The scale for general arrangement drawings shall not be less than 1 to 50 and that for detail drawings shall not be less than 1 to 20, although in exceptional circumstances 1 to 33 may be acceptable, subject to prior agreement.
- (b) Drawings shall be monochrome black line on white paper, at least ISO A3 and not exceeding ISO A0 in size, with a clear margin on each edge of at least 25 mm. Multipage drawing booklets are not acceptable.
- (c) Drawings shall be submitted for approval by the Purchaser on paper in duplicate (2 sets of A3). They shall also be accompanied by equivalent AutoCad .dwg format (version 2010) files on a CDROM or E-Mail as appropriate.

- (d) The name of the site, the drawing number and the date and number of revision shall be marked on all drawings. All drawings shall be numbered according to a logical scheme.



Clause/Sub-Clause		Requirement	Conformance Code	Remarks (Must be completed if Conformance Code is not C1)
3	1	Product not to be changed		
3	2	Electricity North West Technical Approval		
3	3	Quality Assurance		
3	4	Formulation		
3	5	Identification Marking		
3	6	Manufacturers already Approved		
3	7	Product Conformity		
4	1	Requirement for Type Tests at the Suppliers' Premises		
4	2	Requirement for Routine Tests at the Suppliers' Premises		
4	3	Requirement for On Site Tests		
5		Standards		
6	1	Design Features - General		
6	2	Handling of SF <sub>6</sub> and Decontamination Procedures		
6	3	Internal Arc Tested Equipment		
7	1	Extent of Contract		
7	2	Site and Delivery		

7	3	Time for Completion		
7	4	Work to be Executed at Site		
7	5	Manufacturer		
7	6	Drawings and Maintenance Instructions		
7	7	Spare Parts and Tools		
7	8	Portable Testing Plugs and Integral Test Devices		
7	9.1	Works Inspections		
7	9.2	Tests on Site		
7	10	Disposal of Switchgear or its components		
7	11	Manual Handling		
7	12	Failure, Modes, Effect and Cause Analysis		
8	1	General Requirements		
8	2	System Earthing		
8	3	Common Ratings		
8	4	Electrical Endurance		
8	5.1	Dependent Power		
8	5.2	Stored Energy		
8	6	Cable Terminations		

8	7.1	Current Transformers – Type		
8	7.2	Accommodation and Earthing		
8	7.3	Neutral Current Transformers		
8	7.4	Testing Facilities		
8	7.5	Feeder and Outgoing Transformer Circuits		
8	7.6	Bus-Section Unit		
8	7.7	Incoming 132/33kV Transformer Circuits		
8	7.8	Outdoor 33kV Neutral		
8	7.9	Busbar Protection Frame Leakage Check CT		
8	8	Voltage Transformers		
8	8.1	Voltage Transformers for Feeder or Feeder/Transformer Units		
8	9.1	Auxiliary Switches		
8	9.1.1	Standard Provisions of Auxiliary Switches in Primary Substations		
8	9.1.2	Additional Requirements on Grid Transformer Units		
8	9.2	Wire Looms		
8	9.3	Pilot Wiring		
8	10	Auxiliary Supplies		

8	11	Manufacturers Diagrams		
8	12	Gas		
9	1	Busbar Protection		
9	1.1	Earth Fault only with Frame Leakage Check		
9	1.2	Earth Fault only with Current Transformer Check		
9	1.3	Frame Leakage CT Mounting		
9	1.4	Earth Bonds and Connections		
9	2	Busbar Protection Wiring		
9	3	Isolating Features of Secondary Circuits		
9	4	Secondary Wiring Disconnection		
9	5	Auto Reclosing		
9	6	Phasing out of Non-Isolatable Units		
9	7.1	Trip Circuit Supervision – Scheme Required		
9	7.2	Trip Circuit Supervision – Label		
9	8	Control Scheme		
9	9	Selector Switches		
9	10	Circuit Breaker Interlocks		
9	11	Multicore Cables		



9	12	Terminals and Terminal Blocks		
9	13	Platforms and Ladders		
9	14.1	Lifting and Handling Facilities - General		
9	14.2	Additional Equipment – Withdrawable circuit breakers		
9	14.3	Voltage Transformers		
9	14.4	Transport		
9	15	Telecontrol		
9	16	Labels		
Schedule A – Section 1 - Option 1		Protection and Control Relay Requirements		
		33kV Feeder with Translay and Intertripping		
		33kV Feeder with Teed Translay and Intertripping		
		33kV Transformer with HV/LV Adjacent		
		33kV Transformer without Pilots, with Auto-reclose		
		33kV Transformer Feeder with Intertripping		
		33kV Transformer Feeder with Auto-reclose and Intertripping		
		33kV Bus Section		

	33kV Overhead Radial Feeder with Auto-reclose and Distance Protection		
	33kV Overhead Ring Feeder with Auto-reclose and Distance Protection		
	33kV Incoming Transformer Unit		
Schedule A - Section 1 - Option 2	Protection and Control Relay Requirements		
	33kV Feeder with Translay and Intertripping		
	33kV Feeder with Teed Translay and Intertripping		
	33kV Transformer with HV/LV Adjacent		
	33kV Transformer without Pilots, with Auto-reclose		
	33kV Transformer Feeder with Intertripping		
	33kV Transformer Feeder with Auto-reclose and Intertripping		
	33kV Bus Section		
	33kV Overhead Radial Feeder with Auto-reclose and Distance Protection		
	33kV Overhead Ring Feeder with Auto-reclose and Distance Protection		
	33kV Incoming Transformer Unit		

Schedule A – Section 2	Requirements and General Particulars – Basic Units		
	800A Busbar Gear - Feeder Unit		
	800A Busbar Gear - Outgoing Transformer Units		
	800A Busbar Gear - Bus Section Unit		
	2000A Busbar Gear - Feeder Unit		
	2000A Busbar Gear - Outgoing Transformer Units		
	2000A Busbar Gear - Bus Section Unit		
	2000A Busbar Gear – Incoming Transformer Unit		
Schedule B	General Requirements		
Schedule C	Switchboard Arrangement		
Schedule D	Time for Completion		
Schedule E	List of Sub – Contractors		
Appendix C	Drawing Schedule		

Additional Notes: