

Technical Specification
&
Schedule of Standard Equipment
for

11kV Indoor Metal Enclosed Switchgear Specification

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1 SCOPE

This Technical Specification specifies general requirements for non-oil metal enclosed switchgear for 11kV indoor applications. The normal service conditions for this indoor equipment are defined in IEC 62271-1 and EATS 50-18. The equipment shall be designed to comply with the latest issues of the appropriate International Electrotechnical Commission Standards (IEC), British Standards (BSEN) and Energy Networks Association Technical Specifications (ENATS).

This Technical Specification takes precedence over those listed in Section 3 and any previous Company Standards. Other standards and specifications may be consulted if considered to be appropriate and or complementary to those given in Section 3. When standards or specifications not listed in Section 3 are used they should be advised to the Company.

All materials and apparatus forming part of the complete unit shall comply with the appropriate standards and specifications current at the time of tendering unless otherwise agreed in writing by the Company. Any subsequent changes of material or material suppliers to those given in the Tenderers Offer shall be subject to re-approval by the Company.

The design of the equipment shall comply with current UK legislation.

The Tenderer shall state any non-compliance with the appropriate standards, specifications and this Technical Specification. Any non-compliance shall be submitted with the Offer providing details of alternative proposals.

If provided, any proposed layout is given for guidance purposes only.

A Project Specification will be issued for each project, which should be read in conjunction with this Technical Specification. All documentation and communications shall be conducted in UK English.

2 DEFINITIONS

Where definitions are included in a standard or specification listed in Section 3, those definitions are to be used in preference to definitions given in other non-related publications.

The following definitions shall apply at all times:

Company	the Company who is the owner of and responsible for the issue of this Material Standard.
Company's standard operational padlock	the Company has two standard padlocks West standard is: brass and has a body which is 36mm long, 34 mm wide and 15mm deep with a 5 mm diameter shackle having a clear inside width of 19 mm and an inside length of 28.5 mm (closed) and 40.5mm (open). East standard is: The standard EME padlock details are 6.4mm diameter shank, clear inside width of 19 mm and an inside length of 28.5 mm (closed) and 20mm "U" bolt.
Differ	with respect to locking, is a unique tumbler combination or pattern of characters, which distinguishes it from any other tumbler combination or pattern of characters.
Handover Certificate	a Certificate issued by the Tenderer to the Company, which indicates that the Tenderer deems the equipment to be fit for service. It shall bear a unique reference number, be signed by the Tenderer and include the date of signing.
IED	Intelligent Electronic Device – as defined in IEC 61850-1. Any device incorporating one or more processors with the capability to receive or send data/control from or to an external source. E.g. electronic multifunction meters, digital relays, controllers.
Offer	the technical and commercial details, terms, and conditions under which the Tenderer is prepared to supply equipment and services to the Company for a specific project. The Offer shall be in accordance with this Material Standard and the accompanying Project Specification unless indicated otherwise by the Tenderer.
Padlockable	having the facility for applying the Company's standard operational padlock to secure the equipment in the desired position. When in position the padlock must not interfere with the normal operation of any part of the equipment or adjacent equipment nor obscure labelling, indicators etc.
Principal Contractor	as defined in the Construction (Design and Management) Regulations 1994.

Project Specification	is a document specifying the Company's requirements for the number, type, manufacturing requirements, specified works tests, delivery to site, off-loading and (if required) installation on bases prepared by others, multicore cabling, earthing, site testing and commissioning of equipment for a specific project.
Tenderer	any supplier or manufacturer who submits a written Offer to the Company for the manufacture, test, supply, installation and commissioning of equipment. Tenderers will normally have been approved by the Company as registered suppliers and/or manufacturers.

3 REFERENCES

Engineering Recommendation S15	Standard Schematic Diagrams
BS EN IEC 60269 - 1	Cartridge Fuses for Voltages up to 1000V a.c. and 1500V d.c.
BS 381C: 1996	Specification for colours for identification, coding and special purposes
BS EN ISO 1461:1999	Specification for hot dip galvanised coatings on iron and steel articles
BS EN 1706	Aluminium and Aluminium Alloy – Castings – Chemical Composition and Mechanical Properties.
BS 3692:2001	Specification for ISO metric precision hexagon bolts, screws and nuts
BS 3939-1: 1986	Graphical symbols for electrical power, telecommunications and electronics drawings. General information, general index
BS EN 7870 Part 4	LV and MV polymeric insulated cables for use by distribution and generation utilities.
BS EN ISO 2162:1996 Parts 1 -3	Technical product documentation relating to springs
BS EN 60137:1996	Insulating bushings for alternating voltages above 1000V
BS EN 60309-2:1992	Plugs, socket outlets and couplers for industrial purposes
IEC 60044-1	Current Transformers
IEC 60044-2	Voltage Transformers
IEC 60071	Insulation co-ordination – Part 1: Definitions, principles and rule and Part 2: Application guide
IEC 60376	Specification and Acceptance of New Sulphur Hexafluoride
IEC 60480	Guide to Checking of Sulphur Hexafluoride taken from Electrical Equipment

IEC 60502 Part 2 (2005)	Power Cables With Extruded Insulation And Their Accessories For Rated Voltages From 1 kV (U[M] = 1,2 kV) Up To 30 kV (U[M] = 36 kV) - Part 2: Cables For Rated Voltages From 6 kV (U[M] = 7,2 kV) Up To 30 kV (U[M] = 36 kV)
IEC 60529 (2001-02)	Degrees of protection provided by enclosures
IEC 62271-201	High-voltage switches - Part 1: Switches for rated voltages above 1 kV and less than 52 kV
BS EN 60694	Common specifications for high voltage switchgear and control gear standards
IEC 62271-100	High-voltage switchgear and control gear - part 100: high-voltage alternating-current circuit-breakers
IEC 62271-200	High-voltage switchgear and control gear - Part 200: A.C. metal-enclosed switchgear and control gear for rated voltages above 1kV and up to and including 52kV
EATS 09-6	Auxiliary Multicore and Multipair Cables
EATS 12-11	Indoor and outdoor cable boxes for switchgear for service at system nominal voltages of 6.6 kV, 11 kV and 33kV
ENATS 35-17	Class X current transformers
EATS 41-16	Apparatus terminations, conductor sizes and associated fittings (Cu) used in outdoor and indoor substations with outdoor equipment
EATS 41-24	Guidelines for the design, installation, testing and maintenance of main earthing in substations
EATS 41-36	Distribution switchgear for service up to 36kV (cable and overhead conductor connected)
EATS 48-2	Fault passage indicators for 6.6kV and 11kV underground and overhead systems
EATS 50-18	Design and application of ancillary electrical equipment
EATS 50-19	Standard Numbering for Small Wiring (for switchgear and transformers together with their associated relay panels)
EATS 98-1	Surface Preparation and Coating Systems for New Plant and Equipment.

SAFETY SIGNS REGS Health & Safety (Safety Signs and Signals) Regulations 1996

RAL A structured system of colour identification first introduced by RAL Deutsches Institut für Gütesicherung und Kennzeichnung in 1927. The 4-digit RAL colours fulfil the colour requirements of DIN regulations and are used as colour standards by industries worldwide.

4 GENERAL REQUIREMENTS

It shall be generally preferred that all equipment, switchgear and protection relays, provided has been approved by the appropriate Energy Networks Association Assessment/Approvals Panel. Where equipment has not achieved approval as defined above additional information shall be provided and/or requested to confirm its acceptability.

4.1 The Company System

Table 1 lists the Company system parameters for 11kV (nominal) connected equipment.

TABLE 1 - COMPANY SYSTEM PARAMETERS

Nominal System Voltage	11 kV
Rated voltage	12 kV
Rated Normal current (Feeder circuit)	630, 1250,(2000)A
Rated Normal current (Bus bar)	1250, 2000 A
Rated frequency	50 Hz
Rated short-time withstand current (3ph symmetrical)	20 kA for 3s
Rated short-time withstand current (Single Phase to Earth)	20kA for 3s
Rated lightning impulse withstand voltage (peak value) To earth, between poles and across open switching device: Across the isolating distance	95 kV 110 kV
Rated 1 min power frequency withstand voltage r.m.s. value To earth, between poles and across open switching device: Across the isolating distance	28 kV 45 kV
Auxiliary supply	Nominal supply voltage 110 V d.c. High impedance earthed centre point used for the detection of earth faults on either pole

4.2 Equipment Design

The equipment shall be generally compliant with ENATS 41-36 and the relevant parts of IEC 62271-100 unless otherwise varied by this document. All equipment supplied in accordance with this specification shall have been subject to approval by the Company prior to placement of the order.

In order to provide maximum operator safety the three main functions i.e. the busbars, circuit breakers and the cable box shall be segregated by an earthed metal sheet. The switchgear offered shall be internal arc tested in all compartments to comply with IEC 62271-200 and ENATS 41-36.

All systems supplied by the substation 110 V battery shall be required to operate throughout the voltage range defined in IEC 62271-100.

Each discrete operational component of the circuit breaker shall be clearly labelled in accordance with clause 5.4.4.4 of BS EN 60694. Labels shall be clearly visible from the normal operating position and labels shall indicate the function of the component, not merely a reference number.

Means shall be provided to enable the extent of main interrupter contact condition and/or remaining rated life to be determined. These means shall be described in the Offer and included in the operating and maintenance manuals.

Circuit breakers employing methods of arc extinction and insulation not listed in this Technical Specification may be offered for consideration.

Interrupters shall be readily replaceable.

All circuit breakers shall be suitable for auto-reclose duties. Sequence: O–0.3secs–CO–15secs–CO.

Number of mechanical operations:

Circuit breakers intended for auto-reclose duty should preferably be extended mechanical endurance Class M2, able to perform 10,000 operating cycles as described in sub-clause 4.110 of IEC 62271-100. As a minimum requirement, circuit breakers shall be capable of at least 5,000 operating cycles, and shall be tested for auto-reclosing duty in accordance with table 8 of IEC 62271-100.

Tenderers are to state in the Offer the break times of the circuit breakers proposed.

Classification of circuit breakers as a function of electrical endurance:

Circuit breakers shall be classified Class E2 as defined in sub clause 3.4.113 of IEC 62271-100 and tested in accordance with sub clause 6.112.2 and table 21 (list 1) of IEC 62271-100.

CT details, including ratios, phase, function, classes and serial numbers shall be permanently displayed at a location on the switchgear visible when in service. Vacuum Bottle Serial numbers shall be likewise displayed.

Switchboards shall be arranged in sections so that no more than two transformer incomer panels shall be situated in any one switch room. The Project Specification shall indicate if there is need to depart from this requirement on any given project.

4.3 Mechanisms

Circuit breakers shall have a self contained operating mechanism. The only external source of power shall be the substation 110V battery. For mechanisms using stored energy, facilities shall be provided to give a remote indication when the level of stored energy is incorrect. Any motors used for recharging springs shall be 110V d.c. operated from the substation battery.

Circuit breakers shall be supplied with facilities for automatic operation with both manual and electrical release. Solenoid (S), magnetic actuators or motor charged springs (XEM) are acceptable. Hydraulic or pneumatic operating systems are not acceptable. Other types may be accepted by the Company with prior written agreement.

Anti-pumping facilities shall be provided.

The status of all the stored energy devices used for opening or closing the circuit breaker shall be clearly and separately identified in the mechanism. The indication of the status shall use the wording required by ENATS 41- 36. The use of symbols alone is not acceptable.

4.4 Closed Pressure Systems

If closed pressure systems are offered for arc extinguishing, they shall be provided with gas density or temperature compensated pressure devices in accordance with option (c) of Section 1.5.9 of EATS 41-36.

In addition, for closed pressure systems in which the gas is provided for arc extinction, at the second stage (i.e. when the pressure falls to the minimum functional pressure) the circuit breaker shall be locked out. A visual indication shall be fitted to the switchgear control panel to alert the operator of this condition. Facilities for giving a remote indication of this condition shall be provided. The lockout facility for the "SF₆ Lockout" condition shall be independent of any IED.

Full details of any gas couplings installed for filling and evacuating each chamber shall be supplied with the Offer for Company approval.

Where sealed for life equipment is proposed, this shall be indicated in the Offer.

4.5 Maintenance

The Tenderer shall seek to minimise any maintenance requirements and must state the method and recommended interval of maintenance when submitting the Offer.

Where the Offer includes gas or fluid filled equipment, a full method statement for work on the equipment, filling, emptying, topping up and inspecting shall be provided. This shall include consideration of safe means of access, work, environmental issues, compliance with CDM regulations and the Company's Working at Heights Policy.

4.6 Battery Burden

The Company needs to ensure that the substation can operate properly in the event of loss of a.c. supplies to the battery equipment or failure of the charger. The Company therefore has a preference for equipment that places the lowest possible burden on the substation battery and Tenderers are therefore required to design equipment such that the standing load is as low as reasonably practicable. Tenderers shall indicate in the Offer, the burden placed on the battery, both as a standing load and as intermittent loads. The duration of intermittent loads shall be stated.

4.7 Small Wiring

Small wiring shall comply with EATS 50-18 with a minimum size of 2.5 mm² for current transformer wiring and 1.0 mm² for other wiring. Wiring shall be terminated with compression crimps of the hook type. The terminal blocks shall be of spring-loaded design and accept the hook type of connector in accordance with (EATS 50-18, Part2, Appendix A1, Type B).

Wiring shall normally be ferruled to EATS 50-19 and the Company Telecontrol Standard. The Tenderer may use alternative wiring identification for the equipment's internal wiring only. Alphanumeric coding is preferred and wires shall be indelibly and uniquely identified. Where ferruling is used, all wires shall have ferrules at both ends and such ferrules shall not be easily removable, i.e. shall not be 'C' profile clip-over type. The method of wiring identification, coding and ferruling is to be approved by the Company.

Trip circuit supervision shall be fitted, in accordance with Drg. No E230/401 on all units. An equivalent arrangement may be accepted by the Company with prior written agreement. The monitoring of trip circuits shall be in accordance with BEBS S15 Part 1 type H7 and shall fail safe.

Each protection relay shall have its own dedicated relay test block(s) mounted on the same panel as the relay.

Test blocks shall be selected from the Company approved list. Alternative types may be acceptable with prior written agreement from the Company.

The relay power supply, tripping circuits and all CT secondaries, including the test windings shall be wired to the test block(s). The electrical and physical arrangement shall be as indicated in Company standard drawings.

Test blocks shall be mounted so as to be accessible from front of the circuit breaker or relay panel and shall be flush mounted. No part of any test block shall be less than 0.6m or more than 2m from floor level.

External auxiliary cabling between components of the switchboard shall be installed using armoured cables, preferably PVC/SWA/PVC type. Where other types of cable are used, the Company shall agree a suitable means of protection from mechanical damage or fire. All multicore glands shall be fitted with earth tags on the inside of gland plates. These earth tags shall be earthed to an earth bar with a Green/Yellow PVC insulated cable with a minimum

cross sectional area of 4.0 mm. All multicore glands shall be fitted with locknuts of the same material as the gland itself.

Multicore cables shall be identified with suitable reference numbers on the external and internal side of the gland plate of all outdoor equipment.

Whenever it is necessary to route secondary wiring through compartments containing components charged at high voltage, e.g. from CTs, VTs, position/status indication switches, etc., fixings employing adhesive as the sole means of security shall not be used. Wiring shall be fixed using well proven techniques, with security equivalent to screwed fixings, which are able to endure vibration and temperature and humidity changes/extremes.

Any wiring routed through busbar compartments shall be contained in a continuous steel conduit or trunking dedicated solely for this purpose.

4.8 Fuses and Links

Cartridge fuses and links shall be the normal means of protection and isolation for control, indication, telecontrol and alarm circuits. They shall be in accordance with BS EN 60269 -1. They shall be mounted on the front of the switchgear or on a separate control/relay panel. They shall be at a height which can be easily reached without the need for steps. Fuses and links should be grouped together in a logical order when viewed from the position of their normal withdrawal.

The fuse or link carrier shall be capable of easy and complete removal from the fixed base portion. The fuse carrier and base shall be designed to prevent inadvertent replacement. If the fuse or link carrier is not completely removable, this shall be clearly indicated in the Offer and shall be subject to prior written agreement with the Company.

Fuses and links shall be clearly labelled immediately adjacent to and readily identified with the fixed part of the fuse/link holder. Labels shall be clearly visible from the normal operating position. All fuses and links shall have engraved labels indicating their function (not merely a reference number) and shall be secured by either non-rusting screws or rivets only.

All fuse and link carriers supplied shall be suitable, for fuses and links with dimensions to the requirements of BSEN 60269. Isolating links mounted on terminal blocks are not acceptable for the isolation of the pilot cables. Fuses shall comply with the requirements of BSEN 60269.

Fuse carriers and bases supplied shall be of moulded plastic as EATS 50-18, Issue 2, Part 6 and should be distinctly identified by colour of moulding to indicate fuse link ratings. The colour codes to be as follows:-

2A	VIOLET
4A	BLUE
10A	GREY
16A	GREEN
32A	BLACK
LINKS	WHITE

4.9 Auxiliary Switches

The equipment shall be provided with auxiliary switches to Class 1 of table 16 of BS EN 60694 suitable for use in control, indication and electrical interlock circuits. Transformer incomer circuit breakers (Types T1 to T4 of Table A) shall have a minimum of 5 normally open and 5 normally closed auxiliary contacts for external use. These shall be un-used i.e. in addition to those required for the operation of the circuit breaker. All other circuit breakers shall have a minimum of 2 of each. All auxiliary switches shall be uniquely identified and wired out to the equipment multicore terminal blocks.

4.10 Remote Indications

Facilities for remote indications shall be provided by means of volt free contacts to Class 2 of Table 16 of BS EN 60694 and shall be wired out to the equipment multicore terminal blocks.

4.11 Control

The control circuitry for all equipment supplied shall be fully compatible with the external circuitry detailed in the Project Specification drawings and the Company Technical Specification. Control and selector switches shall comply with EATS 50 -18.

It shall not be possible for an operator to open or close a circuit breaker either electrically or mechanically when it is in service whilst standing adjacent to it, apart from the local mechanical trip facility as described below.

All non-automatic open and close controls shall be independent of any IED.

All control facilities shall be clearly labelled immediately adjacent to the facility. Labels shall be clearly visible from the normal operating position. All control facilities shall have engraved labels indicating their function (not merely a reference number).

The telecontrol system requires all control interposing devices to present an impedance of 500 ohms (tolerance +/- 10%) to the initiating pulse.

The Company telecontrol system provides a two second pulsed output for the operation of all controllable devices. Where a constant status input is required to enable any device to hold the desired state, means shall be provided to achieve this from the two second pulse.

The control facilities required for each circuit breaker are detailed below:

4.11.1 Local Control of Circuit Breakers

Local mechanical tripping of the circuit breaker shall be provided. It shall be by means of a padlockable device, suitably designed (e.g. shrouded) to prevent inadvertent operation. Operation of the device shall be independent of the status of any other control facility or operating mechanism. The colour of the device shall be red. The device shall be labelled "LOCAL MECHANICAL TRIP". If this facility cannot be provided, Tenderers shall indicate in the Offer how tripping of the circuit breaker can be achieved in the event of loss of electrical control.

Where gas is used as the arc extinguishing medium, a label shall be fitted to the circuit breaker, adjacent to the local trip button. The warning label shall be suitably sized and incorporate the general danger warning sign in accordance with the Health and Safety (Safety Signs and Signals) Regulations 1996 and have the following supplementary text "WARNING Do not operate live if gas pressure is at or below lockout level" Operation of this device shall be independent of the status of any other control facilities.

Local mechanical closing facilities are not required. If such a device is fitted as part of the standard design of the equipment, it shall be padlockable and have other means to prevent inadvertent operation.

Local electrical tripping and closing facilities shall NOT be provided. This requirement applies to both hard wired facilities and any local operation by IED.

4.11.2 Telecontrol of Circuit Breakers

Facilities for opening and closing the circuit breaker from the Company telecontrol system shall be provided. This shall be achieved using suitable interposing relays as detailed in the Company Telecontrol Particulars.

A two position padlockable switch labelled "CB TELECONTROL SELECTOR" shall be provided on the circuit breaker panel. The positions shall be labelled "ON" and "OFF". The "ON" position shall enable the circuit breaker telecontrol open/close control functions. Facilities for providing a remote indication "CB Supervisory On" shall be provided from this switch. The "OFF" position shall inhibit the circuit breaker telecontrol open/close control functions.

Where a combination of Zener diode and resistance used to match impedance of the telecontrol impulse coil to the RTU impedance, the Zener diode and resistors shall be robustly mounted and connected. Simply wired to terminal block is not acceptable.

4.11.3 Standby Control of Circuit Breakers

Standby Control facilities are required for all switchboards, unless otherwise stated in the Project Specification. A schematic drawing of the required arrangement, operating notes and a general arrangement of the Standby Control Panel are given in drawing E230/402.

A single wall mounted panel shall be provided for Standby Control of all circuit breakers on the switchboard. The panel shall be labelled "STANDBY CONTROL" on the outside of the door.

The Project Specification will indicate where the panel is to be mounted and whether indoor or outdoor protection is required. If provided as an outdoor kiosk, the kiosk itself shall have an external label.

The Standby Control Panel shall be fitted with the following:

- (1) A two position key operated selector switch. One position shall be labelled "THIS PANEL". The other position shall be labelled "TELECONTROL". The "THIS PANEL" position will disable all the telecontrol CB open/close control functions for the whole switchboard. The key shall be trapped in the "TELECONTROL" position and released in the "THIS PANEL" position. A facility for remote indication of the switch position shall also be provided.

- (2) A three position pistol grip type control switch, with positions labelled “TRIP”, “NEUTRAL” and “CLOSE”, with spring return to, and padlockable in the “NEUTRAL” position.
- (3) A red LED indicator labelled “CLOSED” and a green LED indicator labelled “OPEN”.

Each circuit breaker shall be fitted with:

A two position key operated selector switch labelled “STANDBY CONTROL”, with positions labelled “ENABLED” and “DISABLED”. The switch on every circuit breaker panel shall have the same differ as the key operated switch on the Standby Control Panel. The key in the switch on the circuit breaker panel shall be free in the “DISABLED” position and trapped in the “ENABLED” position.

Explanatory Note: When standby control of a circuit breaker is required the operator shall go to the Standby Control Panel and turn the selector switch to “THIS PANEL”. The operator will remove the key from this switch and take it to the circuit breaker to be operated. The key is then inserted into the circuit breaker “STANDBY CONTROL” selector switch, allowing it to be turned from the “DISABLED” to the “ENABLED” position. The operator will then return to the Standby Control Panel to operate the selected circuit breaker as required.

Following operation of the circuit breaker the sequence will be reversed to return the standby control to normal.

4.11.4 Sensitive Earth Fault Control

For circuit breakers type F3 and type F4 of Table 1 a three position switch labelled “SEF CONTROL SELECTOR” shall be provided on the circuit breaker panel. The positions shall be labelled “TELECONTROL”, “LOCAL OFF” and “LOCAL ON.” The switch shall be padlockable in all three positions. The “TELECONTROL” position shall enable telecontrol switching of the SEF function. The “LOCAL ON” position shall enable the SEF tripping function and disable telecontrol switching of the SEF function. The “LOCAL OFF” position shall disable the SEF function and disable telecontrol switching of that function. Facilities for remote indication of the “TELECONTROL” position shall be provided. Facilities shall also be provided for remote indication of the “SEF ON” status, preferably by the SEF relay itself. Where the relay cannot provide this indication, it shall be provided by a combination of switch and interposing relay contacts.

4.11.5 Auto-Reclose Control

For circuit breakers type F3 of Table 1 a three position switch labelled “AUTO-RECLOSE CONTROL SELECTOR” shall be provided on the circuit breaker panel. The positions shall be labelled “TELECONTROL”, “LOCAL OFF” and “LOCAL ON”. The switch shall be padlockable in all three positions. The “TELECONTROL” position shall enable telecontrol switching of the Auto-Reclose function. The “LOCAL ON” position shall enable the Auto-Reclose function and disable telecontrol switching of the Auto-Reclose function. The

“LOCAL OFF” position shall disable the Auto-Reclose function and disable telecontrol switching of that function. Facilities for remote indication of the “TELECONTROL” position shall be provided. Facilities shall also be provided for remote indication of the “AUTO-RECLOSE ON” status, preferably by the Auto-Reclose relay itself. Where the relay cannot provide this indication, it shall be provided by a combination of switch and interposing relay contacts.

4.11.6 Protection Setting Group Control

All feeder circuit breakers shall be provided with IEDs which have a means of selecting between two different protection setting groups (“NORMAL” and “LIGHT”) by telecontrol.

There is no requirement for selecting the protection setting groups manually on the panel.

Facilities shall be provided to give a local and remote indication of the setting group selected.

4.12 Current Transformers

Current Transformers (CTs) are required in accordance with Table A of this Specification unless stated otherwise in the Project Specification.

All Protection CTs shall be to IEC 60044-1 plus ENATS 35-17 Class X current transformers. They shall be fitted with 10A test windings. Test windings shall be electrically separate and not a tapping off the main winding. All windings (including test windings) shall be wired to test blocks.

All Class X CTs shall have a minimum knee point of 350V. The secondary resistance shall be as low as practicable.

Irrespective of the ratio of the CTs, the thermal rating of the CTs shall match the full current rating of the circuit breaker.

4.13 Voltage Transformers

Voltage transformers (VTs) are required in accordance with Table A of this Specification unless stated otherwise in the Project Specification.

VTs shall be to IEC 60044-2. They shall be rated at a minimum of 15VA per phase, measurement Class 1, protection Class 6P, Voltage Factor 1.2. unless stated otherwise in the Project Specification. A BIL of 95kV is required as specified in ENATS 41-36 Section 1.4.2.

VTs may be three phase units or three single phase units unless stated otherwise in the Project Specification.

The Primary side of VTs shall be star connected with the star point free of earth. The Secondary side shall be star connected with the yellow phase connected to earth via a bolted link within the switchgear panel.

Unless otherwise stated in the Project Specification VTs shall be connected to the circuit side of circuit breakers.

VTs shall be provided with isolating facilities in accordance with ENATS 41-36 Section 10.3. Both Primary and Secondary isolation is required. Such isolation shall be by non-intrusive operations. Fuses and links in accordance with ENATS 41-36 Section 3.3 are acceptable for isolation on the secondary side.

4.14 Event Recorders

The Project Specification will state whether an Event Recorder is required for the project. Where required the supply and installation of this unit and its location will be indicated in the Project Specification. The unit shall be from the Company Approved lists but other types will be considered if prior written agreement from the Company is obtained.

The event recorder shall monitor the status of all 11kV circuit breakers using “b” auxiliary contacts. Each contact should be wired via at least one isolating link type terminal block.

In addition, on all incomer circuit breakers, monitoring of currents in all 3 phases and star point residual is required. This shall be achieved by the use of wedding ring type CTs to provide the current analogue inputs. These CTs are required whether an Event Recorder is proposed initially or as a possibility in the future. The specification of the CTs required to match the Event Recorder will be given in the Project Specification.

Also, on all incomer circuit breakers, monitoring of all three phase voltages is required.

Cabling from the switchboard to the Event Recorder will be within the scope of the Offer unless otherwise specified in the Project Specification. Where the Event Recorder is to be installed on a free-standing panel, all digital and analogue outputs for each section of switchboard will be marshalled to a single point, enabling a single cable to carry the outputs from each section to the Event Recorder.

4.15 Relays

All relays for protection and indication shall be selected from the Company Approved Relay List. All transducers and relays for telecontrol applications shall be selected and connected in accordance with the Company Telecontrol Standard. Alternative types may be accepted with prior written agreement from the Company.

Relays shall provide the full range of protection, control and telecontrol functions detailed in Table A below.

The Tenderer shall specify details of the relays proposed in the Offer.

All protection and indication relays shall be flush mounted. No part of any relay shall be less than 0.6m or more than 2.0m from floor level or any operating platform. Communications ports of relays shall be routed to a suitable socket on the front of the panel.

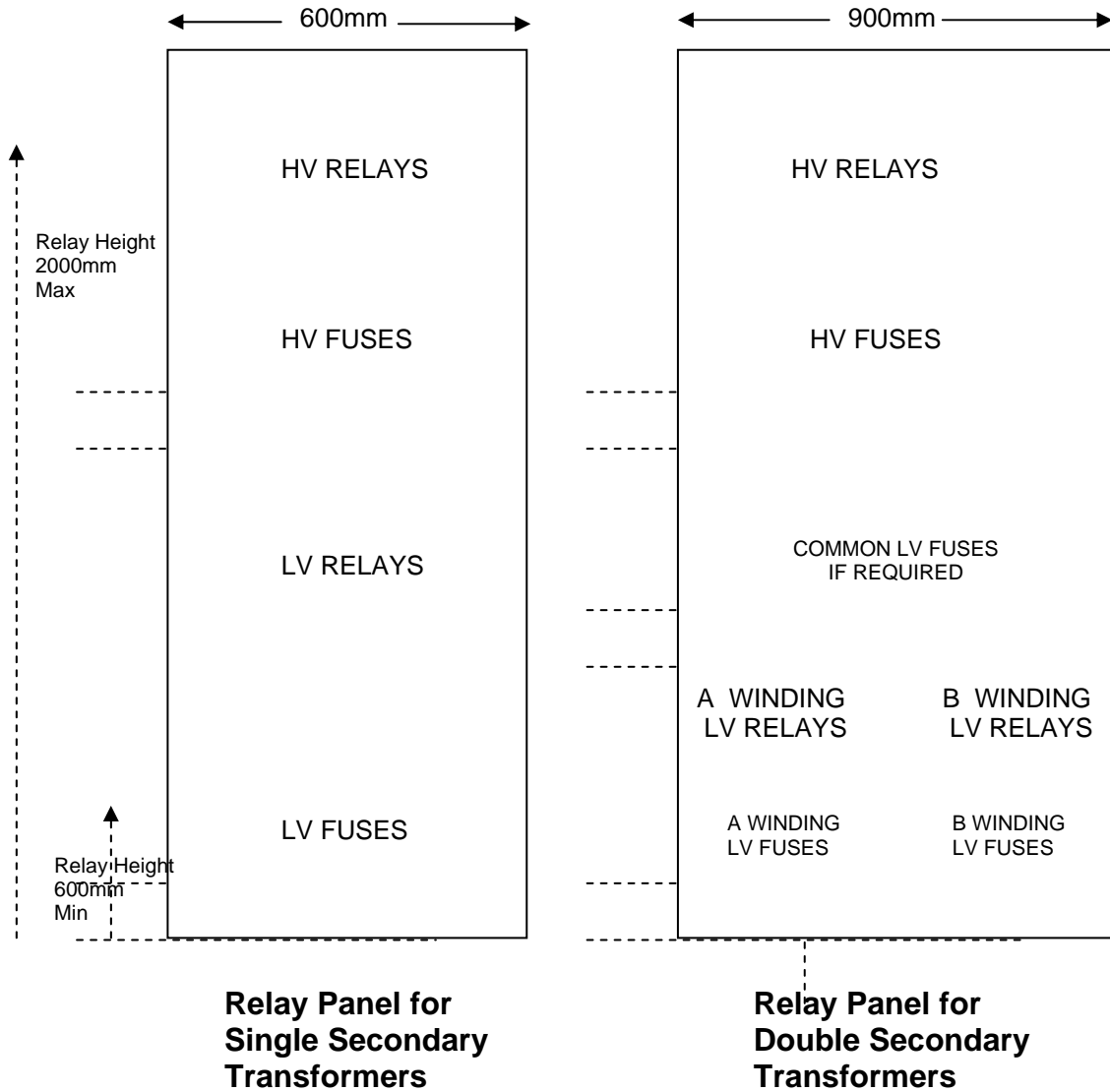
Relays for transformer protection SHALL NOT be mounted on the incomer switchgear panels. They shall normally be housed in a remote free-standing combined HV/LV relay panel. The supply of this panel shall normally be within the scope of the switchgear Supplier, unless the Project specification stipulates otherwise.

For single secondary transformer incomer circuit breakers, a 600mm wide floor mounted cubicle shall be provided to accommodate all HV and LV protection and indication equipment. Equipment shall be arranged with HV uppermost on the panel and LV below, with clear demarcation between the two sections.

For double secondary transformer incomer circuit breakers (Types G2 and G3 of Table A), a single 900mm wide floor mounted cubicle shall be provided to accommodate all the HV and LV protection and indication equipment associated with each individual double secondary transformer. Equipment shall be arranged with HV uppermost and common LV in the mid section. Equipment for each individual LV winding ('A' & 'B') shall be arranged at the bottom most section with 'A' on the left and 'B' on the right, as viewed from the front. The four sections shall be clearly demarcated.

Where there is insufficient space to accommodate all the necessary relays as specified above, alternative arrangements shall be discussed and agreed with the Company in writing.

The general requirements for transformer relay panels are indicated in the drawings below. Note that these arrangements are for relays associated with non GIS switchgear. The arrangements for relays used in conjunction with GIS switchgear will be defined in a separate Technical Specification.



For 11kV feeders, relays shall be fitted on the circuit breaker front panel. If there is insufficient panel space to achieve this, alternative arrangements shall be discussed and agreed by the Company in writing.

Relays and associated equipment shall be suitably positioned on the switchgear to avoid the risk of damage during normal operations. Relays shall not be mounted on doors required for normal operational access.

Programmable relays (IEDs) shall preferably have communications ports fitted. This may be an electrical socket, such as RS232, or an optical port. The preferred location is for the port to be integral with the relay and accessible from the front. Where this is not possible, the port should, where reasonably practical, be mounted adjacent to the relay and accessible from the front of the cubicle.

Where neither of these options is available, a port shall be provided within the cubicle.

The port shall be easily accessible from an operating position in front of the panel.

Where ports are provided on the rear of the relays only, as long as the rear of the relay is easily accessible from the panel position, i.e. by means of a hinged front plate or door, then in such instances, ports on the rear of relays are acceptable. The removal of bolted covers to achieve such access is not acceptable.

In all cases, ports shall NOT be shared between relays; one dedicated port per relay is required. The port shall be clearly labelled.

4.16 Auxiliary Cable Gland Plates

Gland plates for multicore and multipair cables shall be normally bottom entry, fully drilled and suitable for the fitting of compression type glands to take PVC/SWA/PVC multicore and multipair cables complying with EATS 09-6. If top entry cables are required, it will be specified in project spec. All apertures, which are not required immediately for cable entries shall be blanked off or plugged using suitably sized grommets.

4.17 Cubicles, Kiosks and Mechanism Boxes

Unless specified in the Project Specification, 240V a.c. supplies shall not be used.

Where heaters are required to meet environmental conditions, they shall be supplied from a 110V centre tapped earthed a.c. source (55v – 0 – 55v). Both supply terminals are to be fused. Unless otherwise specified in the Project Specification, others will provide the 110V source.

Where socket outlets or lights are fitted, these shall be supplied from a 110V centre tapped earthed ac source (55v – 0 – 55v). Both supply terminals are to be fused.

All doors on Cubicles, Kiosks and Mechanism boxes shall be padlockable.

Relay cubicles shall be no more than 2m high, no more than 600mm deep and not less than 600mm wide.

4.17.1 Indoor situations

Cubicles for indoor installation shall be constructed to EATS 50-18, Part 1, Ambient Class 1.

Glass fronted doors are NOT required. All indoor panels shall be provided with apertures giving adequate natural ventilation to dissipate the heat produced by relays and other components.

Cubicles will not require heaters unless otherwise stated in the Project Specification. Internal lighting (110V a.c.) is required and shall be activated by an automatic switch fitted to the rear door.

4.17.2 Outdoor situations

Kiosks for outdoor installation shall be constructed to class IP54 of BS 60529. They shall be vented and normally constructed of Aluminium, Stainless Steel, Mild Steel or alternative materials acceptable to the Company.

4.18 Designations and Labelling

All equipment shall be clearly and permanently labelled. The label details and plant designations will be defined in the Project Specification. A labelling schedule shall be provided with the General Arrangement drawings for approval by the Company.

Each circuit breaker shall be fitted with circuit designation labels in accordance with ENATS 41-36.

A circuit identification name plate shall be mounted on both front and rear of each panel.

Equipment rating plates and serial numbers shall be located in a conspicuous and easily readable position.

For cubicles and kiosks, labels are to be provided on the inside and outside of all doors. The labels shall be engraved, black lettering on white background. Positions of any other labels shall be agreed by the Company at the time of order.

Busbar sections of metal enclosed switchgear shall be labelled by providing two outward pointing horizontal arrows at each bus section circuit breaker, each arrow labelled in accordance with its adjacent section of busbar. The style and size of this marking shall be agreed with the Company.

Labels for Mandatory, Prohibitory, Warning or Information purposes shall comply with the Health and Safety (Signs and Signals) Regulations 1996. Where labels are provided for making clear the method of operation of apparatus they shall be concise and preferably diagrammatic in form. Danger labels shall be fitted in appropriate places.

Labels shall be of a suitable material. Fixing screws or nut/bolts shall be stainless steel or other corrosion resistant material. Labels fixed by adhesive shall be considered but are not preferred. Where the use of vitreous enamelled labels is approved, the whole surface including the back and edges shall be properly covered and protective washers shall be provided front and back on the fixing screws.

All labels shall be submitted for approval.

The equipment shall have the approved designation labels inscribed and fitted before delivery.

4.19 Earthing

Switchgear, structural steelwork, mechanism boxes, local control kiosks, equipment operating handles and operating platforms shall be capable of being earthed in accordance with Clause 5.3 of BS EN 60694.

A continuous copper earthing tape running the complete length of the switchboard and Complying with the requirements of EATS 41-24, section 1.22 shall be included. Relay panels, where appropriate shall be similarly equipped.

Provision shall be made for connecting the switchboard and relay earths to the substation earth. The copper earth tape to connect the equipment earth to the substation earth shall be provided and installed by a Principal Contractor or CN staff.

4.20 Equipment Finishes

Finishes shall comply with EATS 98-1.

Mild steel intended for outdoor use shall to be galvanised to BS EN ISO 1461, after cutting and drilling. Any distortion caused by the galvanising process is to be corrected prior to delivery.

All fixings for outdoor use shall be stainless steel or galvanised to BS EN ISO 1461 and where appropriate shall be of high tensile steel (grade 8.8) in accordance with BS 3692:2001.

When a painted surface finish is used, the Company's standard colours are:-

For outdoor equipment - Dark Admiralty Grey 632 from BS 381 (Gloss) or RAL 7032 Pebble Grey.

For indoor equipment - Light Admiralty Grey 697 from BS 381 (Semi-gloss), or RAL 7032 Pebble Grey.

Any variation from the standard colour and texture will be specified in the Project Specification.

Alternative finishes, particularly the Tenderers standard finish, will be considered by the Company. Variations from the above standard finishes shall be clearly identified in the Offer. Use of alternative finishes shall be subject to prior written agreement with the Company.

4.21 Foundations and Floors

The switchgear may be mounted on unistrut foundation channels or fixings inserted directly into the concrete floor finish. The switchgear supplier and the appointed civil contractor must co-operate to ensure that the required fixings are provided to suit the switchgear design.

Any fixings required for securing the switchgear to the floor shall be included in the Offer.

The switchgear supplier shall specify with the Offer the switchgear fixing requirements, floor tolerances and any other details to ensure correct installation. Where installation is included in the Tenderers scope of work, the Tenderer shall confirm in writing to the Company that the installed floor and fixings meet these requirements before delivery of the switchgear.

4.22 Interlocking

An electrical interlock is required from the 11kV incomer circuit breakers to their associated HV transformer disconnectors to prevent the HV disconnector being opened unless the incomer circuit breaker is open. A mechanical (key) interlock is required from the circuit earth switch on each incomer to the associated HV transformer earth switch to ensure that the HV earth cannot be applied unless the incomer earth switch is closed.

Where interlocks are provided they shall not be fitted to any parts that can be removed without the use of tools.

4.23 Special Tools and Spares

All tool kits and special tools supplied shall be securely stored within the circuit breaker or otherwise in wall mountable toolboxes. Where toolboxes are required they shall be supplied by the switchgear supplier. Any necessary tools and toolboxes shall be included in the Offer.

The Tenderer shall indicate in the Offer recommendations for spares, earthing devices and test equipment and whether these have been included in the Offer.

4.23.1 Operational requirements

Portable testing plugs and integral test devices to ENATS 41-36 shall be provided.

The number of jumper/test leads, earthing attachments, earthing trucks, test plugs and special tools, where appropriate to the type of switchgear, will be specified in the Project Specification.

4.23.2 Maintenance requirements

Maintenance tools shall be provided on the basis of one set per circuit breaker unless otherwise stated in the Project Specification. Any special tools required for maintenance

shall be provided as part of the Offer. All tool kits shall be supplied in wall mountable tool boxes.

4.24 HV Insulation and Bushings

The Tenderers Offer must specify the types of insulating and bushing materials to be used in the offered switchgear. Full technical particulars should be provided on request.

All bushings are to be rated for the full rating of the circuit breaker.

4.25 HV Cable Terminations

Power cables may be terminated into conventional cable boxes or by the provision of cable termination chambers. Cable terminations will be bottom entry unless modified by the Project Specification. Where conventional cable boxes are provided they shall comply with EATS 12- 11.

All power cable terminations will be of the dry type, made off onto single core XLPE cable to BS7870 Part 4. Terminations will be made using either bolted lugs or plug and socket connections. Where bolted lugs are used, the Company will provide the terminations. Where plugs and sockets are to be used, the Tenderer shall provide both plugs and sockets. The type shall be agreed in advance by the Company in writing.

The design of the cable connection shall be such that the full current rating of the unit is maintained when connections are made.

Unless stated otherwise in the Project specification, 630mm² cable will be used on transformer incomer and cabled interconnector circuit breakers, and 300 mm² cables will be used on all feeder circuit breakers.

Suitable non-ferrous split gland plates shall be provided which facilitate cable installation and removal by the removal of the gland plate sections only.

For 630 mm² and 300 mm² single core XLPE cables, stuffing glands shall be supplied by the Tenderer and the switchgear gland plates shall be drilled to suit the glands.

The centre of each hole in the gland plate shall be in line with the centre of the corresponding cable termination point.

Unless otherwise indicated in the Project Specification, 2000A units shall be designed to accommodate three 630 mm² cables per phase, 1250A units shall be designed to accommodate two 630 mm² cables per phase and 630A units shall be designed to accommodate one 300 mm² cable per phase.

4.25.1 Plug and Socket Connections

Plug and socket connectors shall be suitable for the Company standard cables. Details of the cables currently used by the Company can be provided on request. Both sockets and plugs shall be supplied by the Tenderer.

4.25.2 Bolted Connections

Bolted connections shall be made using shear bolt lugs. These will be provided by the Company.

Where the cable termination facility is provided by a bushing connection, the bushing shall be suitable for the application of a heat shrink encapsulating 'boot' over the termination.

The Tenderer shall confirm that the Company's required BIL rating can be achieved with the cable terminations used by the Company.

4.26 Voltage Indication and Phase Comparison Systems

The Company requires that each circuit breaker has a means of voltage indication and phase comparison. This shall preferably be by means of either VDS or VPIS systems in accordance with ENATS 41-36. The Tenderer shall state in the Offer the type of system normally supplied with the plant and the Specification to which it complies. The Company has a preference for low resistance (LR) type as these do not require adapters.

The equipment manufacturer and type shall be approved in writing by the Company.

The system shall comprise of that equipment built into the circuit breaker and also the separate plug in devices used for voltage indication and phase comparison (including any adapters). Unless otherwise stated in the Project Specification two sets of separate plug in devices will be required for each switchboard. All such devices shall be supplied in a suitable container for retention at the substation. The Offer shall include, but separately identify, the costs associated with these separate devices.

The Tenderer is required to have in place, and to be able to demonstrate, a quality control system, which ensures and checks that connections between the capacitive coupling devices and the test points are correct. Furthermore it shall be demonstrated at the Factory Acceptance Test that all completed installations are wired correctly and will provide correct indications.

Whilst the Company prefers equipment with VDS and VPIS facilities, equipment relying on conventional means of proving dead and phasing out will be considered.

5 SPECIFIC REQUIREMENTS

5.1 11kV Feeder Circuit Breakers

A schedule of 11kV switchgear feeder circuit breaker types is given in Table A Sheet 1.

5.2 11kV Bus Section, and Bus Interconnector Circuit Breakers

A schedule of the Company requirements for these units is given in Table A Sheet 2.

5.3 11kV Transformer Incomer Circuit Breakers

A schedule of the Company requirements for these units is given in Table A Sheets 3 and 4.

Electromechanical relays shall be used for SBEF 2. These are to be of the shunt reinforced type, with the wiring included in the trip circuit supervision circuit and have 2 pairs of N/O self reset contacts.

5.4 All Circuit Breakers

Trip Circuit Supervision arrangements are shown in Drawing E230/401.

SF₆ Variations are given in Drawing E230/403

6 TESTING

The tendered price shall include for all necessary costs to subject each piece of equipment to the appropriate tests. An indication of the testing programme shall be included in the Plant Manufacture and Delivery Schedule.

A schedule of the required testing giving confirmation of the test dates shall be provided and notified to the Company. The anticipated test dates should be provided as early as possible in the programme, to the Project Manager. Once agreed a minimum of twenty working days notice shall be given of any proposed changes to the Project Manager. If necessary the Project Manager may defer the proposed dates.

The cost of the appropriate tests as detailed below shall include travel, accommodation and subsistence for two of the Company's representatives to witness such tests. These travel, accommodation and subsistence costs shall be clearly and separately identified in the Offer and will be subject to adjustment based on actual attendance.

6.1 Type Tests

The Tenderer shall provide evidence of type tests undertaken in accordance with ENATS 41-36. Where equipment design is new, type tests are to be agreed with the Company.

If the units offered are of identical design to units which have successfully undergone type tests and have full Electricity Association Type Approval, further type tests will not be required.

The Company reserves the right to witness Type Tests.

6.2 Routine Tests

Routine tests in accordance with ENATS 41-36 will normally be required. The Tenderer shall be responsible for the preparation of reports on all routine tests, which shall be received by the Company within ten working days of test completion.

The Company shall be given the opportunity to witness routine tests.

6.3 Factory Inspection and Acceptance Tests

The Company also requires Factory Inspection and Acceptance Tests (a check on quality, functionality, compliance with the Company standards and any other issues identified by the Company). Factory Acceptance Tests will normally be carried out on the same visit as Routine Tests the arrangements will be confirmed in the Project Specification.

6.4 Site Tests

Site tests will be agreed in advance with the Company and will be defined in the Project Specification. The Company Standard Tick List can be provided on request. The tests shall

include the Company's requirements for Site Testing and Commissioning. Test record sheets shall be produced to an agreed basis.

The Company reserves the right to witness site tests.

6.5 Other Tests

Any additional specific requirements for testing will be stated in the Project Specification.

7 DELIVERY, INSTALLATION AND HANDOVER

Delivery and installation will be by prior arrangement only. Delivery shall include all off loading and any necessary temporary storage.

Risk Assessments and Method Statements for the delivery, off-loading, installation, testing and commissioning will be submitted by the successful Tenderer to the Company at least 15 working days before the activity commences on site.

7.1 Delivery

Prior to delivery, the Tenderer shall visit site and satisfy himself of any constraint regarding delivery. The tendered price shall include for the provision of all equipment necessary for the safe and proper delivery and off loading of the equipment.

The delivery arrangements will be detailed in the Project Specification.

The anticipated delivery date should be provided as early as possible in the programme, to the Project Manager. Once agreed a minimum of 20 working days notice shall be given of any proposed changes. If necessary the Project Manager may defer the proposed dates.

7.2 Installation

Where installation is required as part of the contract, the Company requires the Tenderer to study any site layout drawings provided, visit site and acquaint himself with any access or installation difficulties. A design and installation strategy must be developed to accommodate any site constraints. The tendered price shall include for the provision of all equipment necessary for the safe and proper installation of the equipment.

The scope of any installation work will be detailed in the Project Specification.

The installation process will normally be in two stages.

The first stage involves the placing of the circuit breakers into position. Fixings requiring incorporation in the foundation shall be provided to site in order to meet the civil construction programme.

The second stage will take place after the connection of multicore cables to the circuit breakers and will include the final filling with gas (where applicable) and site testing of the

circuit breakers. The programming of this second stage will be by agreement with the Company.

7.3 Handover

At the point of handover to the Company for putting into service, the Tenderer shall submit a signed Handover Certificate to the Company. This will be deemed the take-over date for the equipment.

8 DOCUMENTATION

8.1 Information Required with the Offer

- A General Arrangement drawing of the switchboard. The Supplier shall specify floor fixing details, tolerances and any other special civil requirements.
- Details of any significant considerations and procedures that may have an impact on Health and Safety matters.
- Where the equipment small wiring uses a numbering system other than EATS 50-19, a wiring schedule and schematic diagram showing the internal connections, functions and internal numbering at the equipment multicore terminal block(s).
- An indicative Plant, Manufacture and Delivery Schedule.

8.2 Information Required Immediately After Award of the Contract

- A detailed Plant Manufacture and Delivery Schedule for comment or approval by the Company.
- Estimated magnetisation curves for current transformers within ten working days of contract placement.
- Progress reports on Plant Manufacture in writing on a monthly basis.

The Company reserves the right, from time to time, to visit the Tenderers works to confirm the progress against the agreed programme.

8.3 Information Required Before Delivery

- A complete set of working drawings as required for completion of the works covered by the Project Specification. These will include general arrangement, schematic diagrams, wiring diagrams, on or before the dates in the Plant Manufacture and Delivery Schedule.
- Test results on or before the dates in the Plant Manufacture and Delivery Schedule.

- Current Transformer measured magnetisation curves at least ten working days before delivery to site.
- One hard copy of the operating and maintenance manual(s), containing copies of installation and maintenance procedures, all relevant test data and 1 print of final record drawings, before the plant arrives on site. Two CD copies of the same information shall also be supplied at the same time. The manuals shall clearly indicate any special considerations and procedures for installation, commissioning, use, maintenance, and disposal in respect of Health and Safety issues, environmental regulations and other statutory obligations.
- The successful Tenderer shall complete plant data templates generated by the Company's asset register and send completed templates to the Company at least ten working days before the first delivery of equipment.

8.4 Information required after Installation

"As installed" records, drawings and a contribution to the Health & Safety File, as required by the CDM Regulations, shall be provided not later than twenty working days after handover.

Health and Safety information is stored in a number of different locations. To accommodate this, the Health and Safety File is divided into discrete sections and contributions to the relevant sections are required. The full list of sections is given below.

The Tenderer is required to select the appropriate sections from the list below, relevant to the Offer.

8.4.1 Description of Project

A brief description of the work undertaken for this project.

8.4.2 Residual Hazards

A detailed list of residual hazards, except electrical hazards. The document shall contain information on how the hazards have been dealt with.

8.4.3 Structural Principles

A list of key structural principles. The document should contain details of structural and loading calculations and safe working loads for roads, floors, roofs, bridges and culverts if applicable.

8.4.4 Hazardous Materials

A detailed list of hazardous materials on site. The document should contain all details of any necessary precautions for the safe use, maintenance or removal of the materials in the future.

8.4.5 Dismantlement

A schedule of dismantlement procedures. The document should list each significant piece of apparatus and detail how the item should be safely dismantled or removed in the future.

8.4.6 Operations and Maintenance Manual

An Operations and Maintenance Manual should be provided for each significant piece of apparatus. The document should provide the information necessary to allow safe operation and maintenance. In particular the document should list recommended methods of safely working at heights (where appropriate) for all normal activities associated with the apparatus. This should take into account fault investigation where reasonably foreseeable.

8.4.7 Buildings and Plant Drawing

The Substation Buildings and Plant Drawing shall be updated and approved, by a suitably qualified or experienced person, as being accurate. Where one does not exist, a Substation Buildings and Plant Drawing shall be produced for the entire site.

8.4.8 Drainage Layout Drawing

The Substation Drainage Layout shall be updated and approved, by a suitably qualified and experienced person, as being accurate. Where one does not exist, a Substation Drainage Layout shall be produced for the entire site.

8.4.9 Substation Circuit Record

The Substation Circuit Record drawing shall be updated and approved, by a suitably qualified and experienced person, as being accurate. Where one does not exist, a Substation Circuit Record shall be produced for the entire site.

8.4.10 Electrical Clearance Drawing

For any open terminal equipment a scale drawing should be prepared showing all electrical clearances, in accordance with BS7354 as amended by the Company Design and Construction manual, to demonstrate that the appropriate clearances have been achieved. This drawing should show a plan view and sections appropriate to the layout. Where one does not exist, an Electrical Clearance Diagram should be prepared for the entire site. For some existing equipment on the site, however, actual measured clearances can not be obtained. The drawing shall clearly identify where clearances for existing apparatus have been calculated.

8.4.11 Other 'as installed' Drawings

All other as installed drawings shall be provided once approved by a suitably qualified or experienced person as being accurate. The drawings shall be file referenced in accordance with the Company standard. To prevent inadvertent duplication of numbers, prior to the updating of the as installed drawings, the substation index shall be requested from the

Company Network Data Services department. All new drawings shall be suitably indexed and the proposed final index returned to NDS for acceptance. Once the proposed index has been accepted, all drawings should be suitably file referenced and copies returned to the Project Manager.

8.4.12 Construction phase Drawings

All construction phase drawings not included in the as installed drawings shall be indexed in the most convenient manner for the Principal Contractor and two copies provided. A printed copy is not required.

8.4.13 Commissioning results

Copies of all commissioning results should be provided as a Microsoft Word 97 document, suitably indexed. This document should also include the actual sequence of the tests undertaken, and by whom, together with the date (and if appropriate, the time) the test was undertaken.

8.5 Contract Drawings

Electrical symbols on drawings shall comply with BS 3939 or any other convention approved in writing by the Company in advance.

Contract drawings shall be submitted to the Project Manager in duplicate as paper prints. The Tenderer shall supply any further paper copies required by the Company.

All contract specific drawings are to include the contract reference and the project title.

Drawings shall be provided in MicroStation (*.DGN) or AutoCAD (*.DWG) format. All other files shall be provided as a Microsoft Word 97 document. Other, commercially available, formats for the electronic version, such as Acrobat Reader (*.PDF), may be accepted by prior agreement.

The Company does not as such approve Contract Drawings. If time permits the Company may make comments on the submitted drawings. Such comments may not necessarily be complete, since they are in any event only offered as assistance to the Tenderer.

All contract drawings shall be provided by the dates detailed in the Project Specification and the agreed Plant Manufacture and Delivery Schedule.

Wiring diagrams shall show items of equipment and terminal blocks for connection of external cables approximately in their physical position and in relation to external equipment. Space shall be allowed for the addition of information relating to the external multicore cables.

No drawing shall relate to more than one circuit breaker unless otherwise agreed in writing.

Any further requirements will be stated in the Project Specification.

9 TERMS AND CONDITIONS

9.1 General Terms and Conditions

The Company's Standard Terms and Conditions will apply.

9.2 Specific Terms and Conditions

In the event of a circuit breaker or other equipment failing to complete a witnessed test to the agreed programme, the costs of the additional or extended attendance by the Company representatives to witness repeated or re-scheduled tests shall be borne by the Tenderer.

		SF ₆ Low/Lockout ²			A/R Supervisory On SF ₆ Falling ² SF ₆ Low/Lockout ² Proton Setting Gp Normal Proton Setting Gp Light Spring Not Charged		
F4	Underground Feeder Non Unit Protection + SEF Protection	IDMT 2OC ⁵ + 1EF + SEF Sensitive Earth Fault Inst Current Display Y ph ¹ Trip Circuit Supervision SF ₆ Falling ² SF ₆ Low/Lockout ²	Yph Current	CB Open CB Close PSG Normal ⁶ PSG Light ⁶ SEF On SEF Off	CB Open CB Closed CB In Service CB Out of Service ³ CB Supervisory On Protn Defective ⁴ SEF On SEF Operated SEF Supervisory On SF ₆ Falling ² SF ₆ Low/Lockout ² Proton Setting Gp Normal Proton Setting Gp Light Spring Not Charged	One 600/10/1A 15VA 5P10 per phase for IDMT.	None

- 1= where relays can continuously display current, ammeter not required.
- 2= where applicable
- 3= CB withdrawn or CB busbar selector in OFF position.
- 4= Protection Defective = Trip Circuit Supervision and Relay Watchdog
- 5= Minimum Requirement
- 6= Protection Setting Group
- 7=To Match CB Rating
- 8=Lockout required only when SF₆ is used for arc extinction.
- 9=Isolating links (red spot) required for pilots. Not to be wired via test block.
- 10= Isolating link (red spot) required for unit protection tripping contact.

10.2 Table A Sheet 2 – Bus Section and Bus Interconnector Circuit Breakers

Type	CB Function	A - Protection & Instrumentation	B – Telecontrol Analogues	C – Telecontrol Controls	D – Telecontrol Alarms/Indications	E – CTs	F - VTs
S1	Bus-Section or Bus-Interconnector with Protection	IDMT 30C + 1EF with blocking signal input. ⁹ Inst Current Display ¹ Trip Circuit Supervision SF ₆ Falling ² SF ₆ Low/Lockout ²	Yph Current	CB Open CB Close PSG "A" ⁶ PSG "B" ⁶	CB Open CB Closed CB in Service CB Out of Service ³ CB Supy On Protection Defective ⁴ SF ₆ Falling ² SF ₆ Low/Lockout ² Spring Not Charged Proton Setting Gp "A" Proton Setting Gp "B"	One 1200/10/1A or 2000/10/1A 15VA 5P10 per phase for IDMT ⁷ .	None

1= where relays can continuously display current, ammeter not required.

2= where applicable

3= CB withdrawn or CB busbar selector in OFF position.

4= Protection Defective = Trip Circuit Supervision and Relay Watchdog

5= Minimum Requirement

6= Protection Setting Group

7=To Match CB Rating

8=Lockout required only when SF₆ is used for arc extinction.

9=The Bus Section and interconnector CBs are to be set at the same settings as the Feeders. The Feeder protection relays shall send a blocking signal to the bus section relay if a fault is detected.

10.3 Table A Sheet 3 – Transformer Incomers (All relays except telecontrol interposing relays shall be on free standing relay panel)

Type	CB Function	A - Protection & Instrumentation	B - Telecontrol Analogues	C - Telecontrol Controls	D – Telecontrol Indications/Alarms	E - CTs	F - VTs
P1 Primary (33/11 kV)	Primary Incomer	IDMT 3OC + 1EF SBEF (electro-mech) LV REF LV Trip Relay Inst Current Display Y ph ¹ Trip Circuit Supervision Directional Overcurrent SF ₆ Falling ² SF ₆ Low/Lockout ²	Y ph Current R-B Voltage MW import MW export MVar import MVar export	CB Open CB Close PSG "A" ⁶ PSG "B" ⁶	CB Open CB Closed CB in Service CB out of Service ³ CB Supy On Protection Defective ⁴ SF ₆ Falling ⁸ SF ₆ Low/Lockout ⁸ Proton Setting Gp "A" Proton Setting Gp "B" Springs Not Charged	One 1200/10/1A or 2000/10/1A 15VA 5P10 per phase for IDMT. ⁷ One 1200/10/1A or 2000/10/1A Class X per phase for BDREF. ⁷ One 1200/1A or 2000/1A 15VA Class 5 in Yellow Phase ⁷ for AVC.	Three phase or three single phase VTs min 30VA/ph Class 1/6P Voltage Factor 1.2
G1 Single Secondary Grid (132/11, 66/11kv) Yd or Yy	Grid Incomer	IDMT 3OC SBEF 1 SBEF2 (electro-mech) LV REF LV Trip Relay Grid Trip Relay Grid Back Up Trip Relay Directional Overcurrent Inst Current Display Y ph ¹ Protection Supply Supervision Trip Circuit Supervision SF ₆ Falling ² SF ₆ Low/Lockout ²	Y ph Current R-B Voltage MW import MW export MVar import MVar export	CB Open CB Close PSG "A" ⁶ PSG "B" ⁶	CB Open CB Closed CB in Service CB out of Service ³ BU Protn Operated CB Supy On Protection Defective ⁴ SF ₆ Falling ⁸ SF ₆ Low/Lockout ⁸ Proton Setting Gp "A" Proton Setting Gp "B" Springs Not Charged	One 1200/10/1A or 2000/10/1A 15VA 5P10 per phase for IDMT. ⁷ One 1200/10/1A or 2000/10/1A Class X per phase for BDREF. ⁷ One 1200/1A or 2000/1A 15VA Class 5 in Yellow Phase ⁷ for AVC.	Three phase or three single phase VTs min 30VA/ph Class 1/6P Voltage Factor 1.2

1= where relays can continuously display current, ammeter not required.

- 2= where applicable
- 3= CB withdrawn or CB busbar selector in OFF position.
- 4= Protection Defective = Trip Circuit Supervision and Relay Watchdog
- 5= Minimum Requirement
- 6= Protection Setting Group
- 7=To Match CB Rating
- 8=Lockout required only when SF6 is used for arc extinction.

10.3 Table A Sheet 4 – Transformer Incomers (All relays except telecontrol interposing relays shall be on free standing relay panel)

Type	CB Function	A - Protection & Instrumentation	B -Telecontrol Analogues	C - Telecontrol Controls	D - Telecontrol Indications/ Alarms	E - CTs	F - VTs
G2 Double Secondary Grid (132/11/11 kv) Ydd	Grid Incomer	IDMT 3OC SBEF 1 (shared) SBEF2 (shared) (electro-mech) NE Check LV REF LV Trip Relay Grid Trip Relay Grid Back Up Trip Relay Directional Overcurrent Inst Current Display Y ph ¹ Protection Supply Supervision Trip Circuit Supervision SF ₆ Falling ² SF ₆ Low/Lockout ²	Y ph Current R-B Voltage MW import MW export MVar import MVar export	CB Open CB Close PSG "A" ⁶ PSG "B" ⁶	CB Open CB Closed CB in Service CB out of Service ³ CB Supy On SF ₆ Falling SF ₆ Low/Lockout ³ Proton Setting Gp "A" Proton Setting Gp "B" Springs Not Charged	One 1200/10/1A or 2000/10/1A 15VA 5P10 per phase in each incomer for IDMT. ⁷ One 1200/10/1A or 2000/10/1A Class X per phase in each incomer for BDREF. ⁷ One 1200/1A or 2000/1A 15VA Class 5 in Yellow Phase in each incomer to match CB rating. For AVC ⁷	Three phase or three single phase VTs min 30VA/ph Class 1/6P Voltage Factor 1.2 for each incomer.
G3 Double Secondary Grid (132/11/11 kv)	Grid Incomer	IDMT 3OC SBEF 1 (one for each secy) SBEF2 (one for each secy) (electro-mech) LV REF	Y ph Current R-B Voltage MW import MW export MVar import MVar export	CB Open CB Close PSG "A" ⁶ PSG "B" ⁶	CB Open CB Closed CB in Service CB out of Service ³ CB Supy On SF ₆ Falling SF ₆ Low/Lockout ³ Proton Setting Gp	One 1200/10/1A or 2000/10/1A 15VA 5P10 per phase in each incomer for IDMT. ⁷ One 1200/10/1A	Three phase or three single phase VTs min 30VA/ph Class 1/6P Voltage Factor 1.2 for each incomer.

Yyy		LV Trip Relay Grid Trip Relay Grid Back Up Trip Relay Directional Overcurrent Inst Current Display Y ph ¹ Protection Supply Supervision Trip Circuit Supervision SF ₆ Falling ² SF ₆ Low/Lockout ²			"A" Proton Setting Gp "B" Springs Not Charged	or 2000/10/1A Class X per phase in each incomer for BDREF. ⁷ One 1200/1A or 2000/1A 15VA Class 5 in Yellow Phase in each incomer to match CB rating. For AVC ⁷	
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1= where relays can continuously display current, ammeter not required.

2= where applicable

3= CB withdrawn or CB busbar selector in OFF position.

4= Protection Defective = Trip Circuit Supervision and Relay Watchdog

5= Minimum Requirement

6= Protection Setting Group

7=To Match CB Rating

8=Lockout required only when SF₆ is used for arc extinction.

11 TABLE B - STANDARD DRAWINGS

Circuit Breaker Type			Drawing Number	
F1	IDMT	AC Schematic	E230	101
		DC Schematic		201
		Alarms		301
		Misc (TCS)		401
F2	Unit + IDMT	AC Schematic	E230	102
		DC Schematic		202
		Alarms		302
		Misc (Standby Control Panel)		402
F3	Overhead	AC Schematic	E230	103
		DC Schematic		203
		Alarms		303
		Misc SF6		403
F4	IDMT with SEF	AC Schematic	E230	104
		DC Schematic		204
		Alarms		304
S1		AC Schematic	E230	111
		DC Schematic		211
		Alarms		311
P1		AC Schematic CTs	E230	121
		AC Schematic VTs		125
		DC Schematic		221
		Alarms		305
G1		AC Schematic SBEF & OC	E230	131
		AC Schematic Diff & REF		132
		DC Schematic		231
		Alarms		331
G2		AC Schematic LV REF & Baised Diff	E230	133
		AC Schematic OC & Plain Balance & SBEF		134
		DC Schematic		232
G3		AC Schematic Bias Diff, LV REF, SBEF	E230	135
		AC Schematic OC & Plain Balance		136
		DC Schematic		233
G1/G2/G3		LDC G1/G2/G3	E230	137
		CT Allocation G1/G2/G3		138
		VT Schematic G1/G2/G3		139

12 LIST OF SUPPORTING DOCUMENTS

1. Company Telecontrol Standard
2. Company Approved Relays List
3. Company Approved Equipment
4. Company Standard AC and DC Schematics for Circuit Breakers
5. Schematic and GA of Standby Control Panel
6. Project Specification for any given project.



Standards.zip (1
MB)



e230_104.dwg (87
KB)



e230_204.dwg
(101 KB)



e230_304.dwg (77
KB)