WESTERN POWER DISTRIBUTION

Serving the Midlands, South West and Wales

Company Directive

ENGINEERING SPECIFICATION
EE SPEC: 10/2

Relating to 12kV and 36kV Outdoor Overhead Conductor Connected Switchgear and VTs (Based on ENA Technical Specification 41-36)

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Approved by P J West
Policy Manager

Date: 4/3/2002

Implementation Plan

Introduction
Relating to 12kV and 36kV Outdoor Overhead Conductor Connected Switchgear and VTs (Based on ENA Technical Specification 41-36)

Main Changes

Amendments have been made to Section 4 ABSD Specifications which include a review and correction of values in Table 8 and an allowance to use pusher style disconnectors; this type of mechanism pushes the male and female contacts apart as opposed to a rocker mechanism which pulls the contacts apart.

Impact of Changes
The following switches will be made available as standard across the whole business.

- 3ph - 11kV Cat 0 190MVA independent manual air break switch disconnectors
- 3ph - 33kV Cat 0 570MVA independent manual air break switch disconnectors
- 1ph & 3ph - 11kV Cat 2 60MVA manual dependent plain make break air break switch disconnectors

Implementation Actions
Purchasing will now use this Equipment Specification in conjunction with the schedule of requirements during tender negotiations.

Team Managers shall inform Planning and Design Engineers and technicians of the variation of switches and their capabilities so that the correct switch can be assigned to the particular locations load requirements. Switch capabilities are outlined in ST: OS2D

Implementation Timetable
This Equipment Specification can be implemented with immediate effect.

Provision for all categories of switch will be put in place after the next ABSD contract has been awarded.

Document Revision & Review Table		
Date	**Comments**	**Author**
06/11/2014	Reference to 41-27 has now been withdrawn and replaced by ENATS 41-36, all references to 41-27 removed in favour of 41-36. Amendments have been made to Section 4 ABSD Specification for the introduction of additional switches these changes include:- •Allowance to use Pusher style disconnectors, which in short push the male and female contacts apart and opposed to a rocker mechanism which pulls the contacts apart. •A review and correction of values in Table 8. Contents page numbering throughout the document was incorrect this has been corrected.	Mike Chapman
25/10/2012	Amendment made to section 1.14 & 4.6 to allow the use of Composite insulators.	Mike Chapman

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(Note: All separate relay panels listed in Section 1A and Section 1B are superseded by EE Spec 87)

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OUTDOOR DISTRIBUTION SWITCHGEAR AND VOLTAGE TRANSFORMERS FOR SERVICE UP TO 36kV (OVERHEAD CONDUCTOR CONNECTED)

FOREWORD

This Technical Specification has been created to bring together in one document a number of related Technical Specifications on distribution switchgear. By establishing all Common Clauses in a single section, repetition has been largely avoided.

Switchgear covered by this Technical Specification shall comply with the latest issues of the relevant British and International Standards listed, with the usual proviso that a period of time will always elapse between the date of publication of a Technical Specification, or the revision of a Technical Specification, and the production of switchgear embodying stated requirements. Only in Parts 3 and 4 has it been necessary to amend parts of the relevant Standards to meet the particular requirements of UK Electricity Supply System.

This document is intended to amplify the requirements of those Standards where it is agreed that further information is desirable for the following reasons:-

(i) To ensure adequate safety and to facilitate compliance with EI Distribution Safety Rules.

(ii) To meet the operational requirements of the EI distribution system.

(iii) To cover requirements not contained in the listed Standards.

(iv) To select ratings appropriate to EI requirements from the wider range contained in the listed Standards.

The opportunity has been taken to include as much guidance as possible on the latest switchgear technologies.

SCOPE

This Technical Specification covers items of switchgear located outdoors and either mounted on poles or structures in the run of overhead lines or as open-terminal equipment within substations.

Some circuit-breaker equipments are required to be fitted with auto-reclosing facilities.

Equipment is to have a rated voltage of up to 36kV three-phase 50Hz for use on systems with the neutral point earthed solidly, or through a resistor or reactor of low impedance or through an arc suppression coil.

REFERENCES

This Technical Specification makes reference to or implies reference to the following documents and it is important that users of all Standards and Technical Specifications ensure that they are in possession of the latest issues together with any amendments. Equipment shall comply with the listed Standards unless otherwise specified to the contrary.

This Technical Specification has been amended to introduce the changes necessary to ensure that it meets the requirements of Clause 11 of The Utilities Supply and Works Contracts Regulations 1992 (Statutory Instrument 1992 No 3279) dated 13 January 1993. British Standards which are the implementation of European Standards are listed in 1below. 2 lists British and International Standards which are not yet harmonised but which are in common use within the European Community within the meaning of the above Statutory Instrument.

(A "European Standard" means a standard approved by the European Committee for Standardisation ("CEN") or by the European Committee for Electrotechnical Standardisation ("CENELEC") as a "European Standard" ("EN") or a "Harmonisation Document" ("HD") according to the Common Rules of those organisations or by the European Telecommunications Standards Institute ("ETSI") according to its own rules as a "European Telecommunications Standard" ("ETS")).

1 - European Standards

Whilst the IEC base document is listed for information, the prime document which shall take priority is the British Standard enacting the European Standard (EN) or European Harmonisation Document (HD).

BS No.	EN/HD ref	Title	IEC / ISO base
BS 88	EN 60 269	Specification of general requirements for cartridge fuses up to and including 1000V ac and 1500V dc	IEC 269
BS 89	EN 60 051-1 to 60 051-9	Direct acting indicating analogue electrical measuring instruments and their accessories	IEC 51-1 to 51-9
BS 5227	HD 187 S5	Specification for metal-enclosed switchgear and controlgear of rated voltage above 1kV and up to and including 52kV	IEC 298
BS 5253	HD 408 S2	Specification for a.c. disconnectors and earthing switches of rated voltage above 1kV	IEC 129
BS 5311	HD 348 S3	Specification for high voltage circuit breakers	IEC 56
BS 5463	HD 355.1	Specification for a.c. switches of rated voltage above 1kV	IEC 265-1
BS 5490	HD 365	Specification for classification of degrees of protection provided by enclosures	IEC 529
BS 5559	EN 60445	Specification for identification of apparatus terminals and general rules for a uniform system of terminal marking using an alphanumeric notation	IEC 445
BS 5750	EN 29001 EN 29004	Quality systems	ISO 9001 ISO 9004
BS 6581	HD 448 S2	Specification for common requirements for high voltage switchgear and control gear	IEC 694
BS EN	60,420	High voltage a.c. switch-fuse combinations	
BS 7625	HD 554 SI	Specification for voltage transformers	
BS 7626	HD 553 SI	Specification for current transformers	

Notes 1. BS 7626 does not include for class X current transformers which are widely used in the EI. To retain compatibility with existing equipment such current transformers will be to BS 3938 until a European standard is published.

2 - Non-harmonised Standards

The British Standards listed below are cross referenced to the nearest International Standard for information, but the British Standard shall have precedence where there are differences between these Standards unless otherwise specified. In the event that the British Standards listed below are superseded by European Standards (as defined in Statutory Instrument 1992 : No 3279) the European Standard shall apply.

British Standard	Nearest IEC/ISO	Title
BS 88-5		Specification of supplementary requirements for fuse links for use in ac electricity supply networks
BS 142		Specification for electrical protection relays.
BS 148	IEC 296	Specification for Unused Mineral Insulating Oil for Transformers and Switchgear.
BS 159		Specification for busbars and busbar connections.
BS 223*	IEC 137	Specification for bushings for alternating voltages above 1kV
BS 381C		Specification for colours for identification, coding and special purposes.
BS 729		Specification for hot dipped galvanised coatings on iron and steel (see note 1 below)
CP 1010	IEC 354	Loading guide for oil immersed transformers
BS 2692		Fuses for voltages exceeding 1000V ac
BS 3297		Post insulators of ceramic material or glass for nominal voltages greater than 1000V.
BS 3693		Recommendations for the design of scales and indexes on analogue indicating instruments.
BS 3939*	IEC 617	Guide for graphical symbols for electric power, telecommunications and electronics diagrams
BS 4781		Specification for pressure sensitive adhesive plastics labels for permanent use.
BS 5207		Specification for sulphur hexafluoride for electrical equipment (see note 2 below)
BS 5493		Protection of iron and steel against corrosion.
BS 5775*	ISO 31	Specification for units quantities and symbols
BS 6423		Code of Practice for maintenance of electrical switchgear and controlgear for voltages up to and including 650V.

British Standard	Nearest IEC/ISO	Title
BS 6480		Specification for impregnated paper-insulated lead or lead alloy sheathed electric cables of rated voltage up to and including 33000V
BS 6553*	IEC 787	Guide for the selection of high voltage fuse-links for transformer circuit applications
BS 6626		Code of Practice for maintenance of electrical switchgear and controlgear for voltages above 650V and up to and including 36kV.
BS 7198*	ISO 7241-1	Hydraulic fluid power quick action couplings
BS 7354		Design of high-voltage open-terminal substations.
ANSI/ IEEE	C37.60	American National Standard requirements for overhead, pad-mounted, dry-vault and submersible automatic circuit recloser and fault interrupters for ac systems.
ANSI/ IEEE	C37.63	American National Standard requirements for overhead, pad-mounted, dry-vault and submersible automatic line sectionalisers for ac systems.

EA Technical Specifications

Technical Specification 12-6 - Time fuse-links.

Technical Specification 12-9 - Wiping glands for metallic-sheathed cables.

Technical Specification 12-11 - Indoor and outdoor cable boxes for switchgear.

Technical Specification 41-15 - Standard circuit diagrams for equipment in 132kV substations.

Technical Specification 41-16 - Apparatus terminations, conductor sizes, and associated fittings (copper) used in outdoor and indoor substations with outdoor equipment.

Technical Specification 41-18 - Partial discharge testing or bushings, capacitors, instrument transformers & switchgear of rated voltage 7.2-420kV inclusive.

Technical Specification 43-92 - Conductor Fittings for Overhead lines.

Technical Specification 48-2 - Fault passage indicators for 6.6kV and 11kV underground and overhead distribution systems.

Technical Specification 43-95 - Steelwork for overhead lines.

Technical Specification 50-2 - Bimetallic ammeters.

Technical Specification 50-18 - Design and application of ancillary electrical equipment.

Technical Specification 98-1 - Surface preparation and paint finishing of new plant and equipment.

Engineering Recommendation S3/1 - Metering current transformers for use in switchgear.

Engineering Recommendation S5/1 - Earthing installations in substations.

Engineering Recommendation S15 - Standard schematic diagrams.

Engineering Recommendation G9/6 - Voltage testing devices.

NOTES

* These British Standards are identical to the IEC/ISO publications.

1. ISO 1459, 1460 1461 do not specify galvanising coating thickness / weight for materials between 1 and 5mm thickness. Accordingly BS 729 is to be used.

2. IEC 376 does not quote dew point / moisture contents in the manner of BS 5207. Equipment suppliers shall provide information at time of tender to state which standard is applicable to the equipment on offer.

Part 1 - Common Clauses

1.1 Introduction of New Forms of Equipment

The existence of WPD Technical Specifications is not intended to restrict or inhibit the introduction of new forms of switchgear provided that such designs comply with those requirements in respect of safety, security and operation which are generally understood by manufacturers and users.

1.2 Quality Assurance

Quality assurance schemes shall be in accordance with BS 5750 / EN29000

1.3 System Earthing

The equipment shall be suitable for use on three phase systems in which the neutral is earthed either solidly or through a resistance or reactance of low value or through a reactor or arc suppression coil. It should be noted that parts of WPDs network employ arc suppression coil earthing and manufacturers are advised to consider carefully the implications of this, with particular emphasis on the phase voltages during earth fault conditions.

1.4 Normal Service Conditions

Ambient Temperature for Equipment - The equipment shall be suitable for operating at a minimum ambient air temperature of - 25 deg C.

1.5 Common Ratings

Rated frequency - 50Hz.
Duration or rated short-time withstand current - 3 seconds except wound primary current transformers. The rated insulation levels and test voltages are to be in accordance with BS 6581 and the lightning impulse withstand level is to be to Table 1 List 2. For equipment specified in Part 3 of this specification some alternative requirements are specified. The rated making current shall be 2.5 times the rated short circuit current. The rated short time withstand current shall be equal to the rated short circuit current for a duration of 3 seconds except for wound primary current transformers. Where auto-reclosing duty is required additional type tests shall be performed as described in Appendix A

Manufacturers shall provide at time of tender, overall dimensions and, for circuit breakers, information showing the number of tripping operations at various fault levels up to full short circuit rating which the equipment can perform before requiring maintenance. Where circuit breakers for auto reclose are called for, manufacturers shall state in their tender the performance level of the equipment offered as defined in appendix A of this specification.

It is sometimes necessary to seek overload ratings under reduced ambient temperature conditions. Manufacturers shall state at time of tender what available steady state

overload rating can be applied to the equipment on offer at 5 deg C intervals down to 0 deg C, and advise on what basis such ratings have been determined.

Table 1- Rated Voltage, Normal and Short-circuit Currents

Rated Voltage kV	Item	Rated Normal Current (A)						Rated Short-Circuit Current (kA)			
		400	630	800	1250	2000	2500	12.5	16	20	25
7.2/12 *	Circuit breaker equipments		X	X	X	X		X	X	X	
7.2/12*	Disconnectors	X	X	X	X	X		X	X	X	
36	Circuit breaker equipments			X	X	X			X	X	X
36	Disconnectors			X	X	X			X	X	X

* Equipments for 7.2kV and 12kV service shall have the same basic impulse level except where limited by voltage transformer design for 7.2kV service (or less). The rated short-circuit making and short-time withstand currents shall apply to the busbar and circuit earthing locations.

The ratings of auto reclosers and sectionalisers are stated in Part 3.

The ratings of fault throwing switches are stated in Part 6.

1.6 Cable Charging and Small Inductive Breaking Currents

These shall be:-

Table 2 - Circuit breaker cable charging and small inductive breaking currents

Rated kV	**Breaking Current A**			
	Cable Charging		**Small Inductive Voltage**	
	Switches	**Circuit Breakers**	**Switches**	**Circuit Breakers**
12	10*	25	2	6.3
24	10*	31.5	3	8
36	16*	50	4	10

* Higher values selected from the R10 series may be stated by the manufacturer.

For equipment with arc interruption in gas, tests for small inductive breaking current shall be carried out at the rated filling pressure (see Clause 1.26.3.1).

1.7 Maintenance

Equipments covered by this Specification shall be designed for maintenance in accordance with the requirements of BS 6626.

Where access to the circuit breaker contacts is not possible, or extremely complex, it shall be possible to make a measurement to determine whether the contacts have eroded so far as to require the circuit breaker to be taken out of service for contact replacement or its equivalent. A simple count of numbers of operations at assumed maximum substation fault level is not acceptable.

Tenderers shall also include a proposed method of measuring cumulative circuit breaker I^2t duty for substation circuit breakers.

1.8 Degree of Protection

Equipment shall provide a Degree of Protection (BS 5490) not less than IP33 on those parts accessible from ground level.

The enclosure of all mechanisms shall meet Degree of Protection IP20.

The design of equipment shall ensure that trip buttons and operating handles are located such that their normal operation will not present any possibility of contact with a moving mechanism or other possible cause of accidental injury.

1.9 Colours

Where specific colours are stated, they shall have the following reference numbers in BS 381C:-

Grass Green	218
Lemon	355
Signal Red	537
Dark Admiralty Grey	632

1.10 Nameplates

1.10.1 Equipment supplied to European, International or British Standards

The data required is set out in the appropriate Standard. High voltage equipments shall however, always be provided with a unique identifying reference such as a serial number

1.10.2 Equipment supplied to this Specification 41-36 and for which there is no current EN, HD, BS or IEC.

1 The following data is required, as appropriate,

(i) Manufacturer's name
(ii) Equipment to Technical Specification 41-36 Part....
(iii) Type reference
(iv) Serial number
(v) Year of manufacture
(vi) Mass (with insulant) kg
(vii) Insulant type/content/pressures litres/bars gauge at 20-C

(viii)	Rated Voltage (U)	kV
(ix)	Frequency	50Hz
(x)	Lightning impulse withstand voltage (Uw)	kV
(xi)	Normal current (In)	A
(xii)	Short-circuit making current (Imc)	kA
(xiii)	Short-circuit breaking current	kA
(xiv)	3 second short-time current (Ith)	kA
(xv)	Earth switch peak making current	kA
(xvi)	Earth switch 3 second short-time current	kA
(xvii)	Testing Standards e.g. BS 7426, BS 5311, BS 5253 and BS 5463	

1.11 **Operating Mechanism**

1.11.1 **General**

Each switching device shall be fitted with an operating mechanism of one of the following types as appropriate and as required by the purchaser:-

(i) DM mechanism - dependent manual operation.

(ii) XA mechanism - independent manual operation.

(iii) XAM mechanism - independent motor charged spring operation.

(iv) XM mechanism - stored energy operation by means of energy stored in a manually-charged spring with manual release.

(v) XE mechanism - as type XM, but also with electrical release.

(vi) XEM mechanism - stored energy operation by means of energy stored in a motor-charged spring with manual and electrical release.

(vii) S mechanism - solenoid-operated dependent power operation.

(viii) M mechanism - motor operated mechanism.

It shall only be possible to operate a mechanism by applying the operating handle in the correct manner.

With all operating mechanisms the connection between the output lever of the mechanism and the switching device contacts shall be such that under all conditions the drive is positive in both directions.

During operation, any overshoot of the moving contacts shall not reduce any electrically stressed gap to such an extent as to initiate a disruptive discharge to earth or between poles.

Positively driven mechanical indication of the operating positions of a switching device shall be provided. For a circuit breaker these shall show whether it is "ON" or "OFF" when in the Service, Isolated and Earth locations, and one only of these

indications shall be visible at any one time. For an earthing switch ancillary to a circuit breaker the indicator shall show whether it is in the "EARTH ON" or "EARTH OFF" position. For a switch the indicator shall show whether it is in the "ON", "OFF" or "EARTH ON" position.

For a manually charged mechanism the maximum operating effort shall be assumed to be available a different operating heights from ground level as shown in Table 3.

Table 3 - Maximum Operating Effort for Manually Charged Mechanisms

Max. Force (Newtons)	Max. Handle Height (mm)	Min. Handle Height (mm)
400	1,250	300
320	1,850	300

In addition to the above requirements, circuit breaker mechanisms may be either trip free or fixed trip. Anti-pumping arrangements are required. (ie circuit breaker mechanisms shall be so designed that if the closing and opening releases remain energised simultaneously the circuit breaker will not operate again until both have first been de-energised.) Manual tripping of the circuit breaker shall be by means of a push button shrouded to avoid inadvertent operation.

For auto-reclosing circuit breakers the mechanism reset time following a trip operation shall not exceed 0.5 second and the maximum rewind time of a type XEM mechanism shall not exceed 10 seconds. Alternatively, by agreement with the purchaser a maximum rewind time of up to 35 seconds may be acceptable.

A counter shall be fitted to the mechanism of each circuit breaker equipment arranged to summate all the opening operations. It shall be visible with the equipment live and in its service position.
Auxiliary switches shall be provided as detailed in Appendix B of this specification.

When not in use, any spring charging handle shall occupy a stowed position where it shall not cause any obstruction. If the design is such that the handle is lifted into the engaged position prior to operation, it shall be possible to release it again and return it to the stowed position without moving the contacts of the switching device.

Operating mechanisms shall be designed to permit maintenance of the associated switching device. If this requires the manual (slow) closing and manual (slow) opening of the switching device, the facility provided shall be such that it cannot be used when the switching device is in the Service and Earthing locations, unless each (slow) closing operation necessitates a manipulation quite separate and distinct from that associated with normal operation.

Any separate components associated with maintenance closing and opening shall be labelled "FOR MAINTENANCE PURPOSES ONLY".

Motor-charged spring-operated stored-energy mechanisms shall recharge after the circuit breaker has been closed. They shall also be provided with means for charging the springs safely by hand.

Preferably all forms of operating mechanism for the same type and rating of equipment of a given manufacturer shall be interchangeable as units.

1.11.2 XA and XAM Mechanisms

Operating handles shall be arranged to operate in a vertical plane and clear indication shall be given of the direction of motion needed to complete the "ON" and "EARTH ON" operations.

It shall not be possible to charge the closing springs with the switching device in the closed position.

It shall not be possible for such a mechanism to be left in a condition whereby any energy which has been stored during the initial part of an incomplete operation remains in the mechanism when the switching device is open or closed. In addition movement of an operating handle against an interlock shall not charge any spring to any significant extent.

1.11.3 XM, XE and XEM Mechanisms

It shall be possible to re-charge the closing springs when the switching device is closed and if the springs can be and are released the device shall not open nor shall this operation result in mechanical damage to any component. If the springs are recharged after the switching device has been closed, they shall not be discharged by the shock of short-circuit interruption.

These mechanisms shall be fitted with a local manual spring release and if required by the purchaser provision shall be made for fitting a lanyard.

The spring charging handle shall not move when the spring energy is released to close the switching device.

A visible mechanical indicating device shall be provided to indicate the state of the spring and shall be inscribed "SPRING CHARGED" when the mechanism is in the condition to close the switching device and "SPRING FREE" when it is discharged.

If required by the purchaser an auxiliary switch shall be fitted to give a remote indication or "SPRING CHARGED" or "SPRING FREE".

1.11.4 S Mechanisms

Solenoid mechanisms shall be fitted with anti-pumping facilities. A closing selection socket shall be provided if specified in the accompanying schedule.

1.11.5 M Mechanism

An integral direct motor drive for operating a disconnector.

1.12 Interlocks

Interlock mechanisms shall be mechanical and when manually operated they shall be provided with labels which are readily visible and which contain clear concise instructions for operation.

Preventive interlocks or measures shall be provided to comply with BS 5227.

1.13 Labelling

1.13.1 General

Labels shall be durable non-fading and, apart from circuit labels, permanently attached to the equipment.

Label inscriptions shall be in accordance with Table 4.

Each switchgear equipment shall be fitted with a circuit label as shown in Fig 1. When the label is attached by screws these shall be non rusting for easy replacement.

1.13.2 Phase Identification

The phasing of all primary terminals shall be indelibly marked on the main structure adjacent to the terminals. The marking shall not be on removable covers. The standard phase markings are red, yellow, and blue. Alphanumeric Marking in accordance with BS 5559 shall also be provided.

Table 4 - Standard Label Requirements

Function	Inscription	Background Colour	Letter Colour
Circuit Breaker, Switch, Earthing Switch, Disconnector or Switch-disconnector position	ON	Signal Red	White
	OFF or EARTH OFF	Grass Green	White
	EARTH ON	Lemon	Black
Switch Description	CIRCUIT SWITCH	White	Black
	EARTH SWITCH	Lemon	Black
Circuit Breaker Operating Mechanism Spring State	SPRING CHARGED	White	Black
	SPRING FREE	White	Black
Circuit and Other Operational Labels	As Required	White	Black

1.14 Support Insulators

Glass or ceramic insulators shall comply with BS 3297. Composite Insulators for overhead line plant and equipment shall comply with the latest version of ENA-TS 43-93. Insulators may be of pedestal or cylindrical type with two or four fixing points. The fixing holes at each end of the insulator shall be tapped M12 or 14mm clearance as appropriate. They shall be in line and equally spaced on 76mm pitch circle diameter.

1.15 Terminations, Conductors and Fittings

1.15.1 General

Terminations, conductors and fittings shall comply with EA Technical Specification 41-16.

1.15.2 Clearances

Clearances shall comply with BS 7364 or Distribution Safety Rules whichever is the greater.

1.16 Padlocking

Wherever padlocking facilities are required by this Technical Specification, provision shall be made for a padlock with 38mm square body and with a 7mm diameter shackle having a clear inside width of 20mm and an inside length of 16mm to 30mm. The holes provided for the shackle shall not be less than 8mm diameter.

Page amended 25th October 2012

1.16.1 **Requirements for Padlocking Facilities**

Padlocking facilities requiring the use of a single padlock only without additional loose devices shall be provided so that:

(i) a switching device can be prevented independently of other operations from being closed when it is open;

(ii) a switching device can be prevented from being opened by manual operation of the mechanism when it is closed except that it shall not be possible to lock mechanically any trip mechanism having electrical release;

(iii) circuit and busbar earthing facilities can be independently locked to prevent inadvertent earthing.

1.17 **Earth Bonds and Connections**

1.17.1 **General**

Earthing conductors and connections to them shall be provided in accordance with the requirements of BS 7354 except that pending revision of the current edition the maximum current density shall be 125 A/mm² (copper conductors). The earth bar shall be secured to the frame and located so as to provide convenient facilities for use with any earthing leads in accordance with Electricity Board Safety Rules (Distribution).

The earth terminal shall be durable and at least size M12 and shall be marked with the earth symbol shown in BS 3939.

Relay and instrument cases shall be earthed in accordance with the requirements of EA Technical Specification 50-18, Part 1 Clause 6.3.

1.18 **Cleaning and Painting**

1.18.1 **General**

Galvanising or zinc spray coating shall be used on ferrous surfaces.

By agreement an alternative corrosion protection treatment may be acceptable so long as it can be demonstrated that the performance of the alternative treatment is at least equal to that based on zinc spraying.

It is preferred that the final coat of paint on all exterior surfaces shall be Dark Admiralty Grey, except when an alternative colour is agreed.

Surface preparation and paint finishing shall comply with the requirements of EA Technical Specification 98-1. It is also required that the system provided shall have a minimum life to first maintenance repaint of at least 10 years in an exterior polluted coastal environment as defined in BS 5493.

1.18.2 **Zinc Spray**

Surface preparation shall be in accordance with BS 2569.

All ferrous exterior surfaces shall be cleaned of scale and rust by shot-blasting or other approved method and shall then be treated on the same day, normally within 4 hours, without outdoor exposure, with a zinc spray. The zinc shall be applied by the flame gun process of a thickness Zn4 in accordance with BS 2569: Part 1: 1964, Clause 5. Exterior surfaces shall be taken to refer to all surfaces outside weatherproof gasketted joints whether or not they are directly exposed to sun or rain.

Zinc sprayed surfaces shall be painted.

1.18.3 **Galvanising**

Galvanising shall be applied by the hot dip process in accordance with BS 729.

Oversize tapping or re-tapping of female threads shall be provided where the bolt or male thread is hot dip galvanised. Nuts shall be tapped up to 0.4mm oversize after galvanising and the threads shall be oiled. Bolts and screwed rods shall be galvanised after thread forming. The threads of all bolts and screwed rods shall be cleared of spelter by spinning or brushing. A die shall not be used for cleaning the threads unless approved by the purchaser.

Galvanised surfaces to be painted shall have an etching primer applied before painting.

1.19 **Lifting Facilities and Weight Marking**

Each complete equipment shall be provided with adequate lifting facilities and shall be marked to indicate its maximum weight, in kg, when fully equipped. Where lifting equipment is included with the equipment it shall be provided with proof test certification.

1.20 **Heater**

Unless a requirement for a heater is specified in a later part of this specification, by agreement with the Purchaser the manufacturer may fit heaters in order to protect insulation from condensation or to retain performance under low ambient temperature conditions. The manufacturer must advise such a decision at time of tender to enable WPD to consider the provision of necessary low voltage supplies to the equipment. The supply voltage for such heaters shall be 110V or 240V a.c. as stated by the purchaser. The heaters shall conform to EA Technical Specification 50-18 Part 1 sub-clause 10.2.

1.21 **Instruction Manuals, Special Tools and Consumable Spares**

Four copies of the manufacturer's handbook shall be provided and its content shall follow the guidelines of IEC 694 (BS 6581) clause 10 and BS 6626, Appendix B . All

manuals, handbooks drawings and other technical information shall be provided in English.

Special tools required for the operation and maintenance of the equipment shall be supplied with the switchboard as detailed in the accompanying schedules. A suitable container or rack for wall mounting shall be provided for such tools. The tools shall be clearly labelled to indicate the purpose for which they have been supplied. If a tank lowering or similar device is provided, the safe working load shall be marked on the device. In addition, if the device is removable and can be used for other purposes, such as "pul-lifts" then a certificate from a registered testing station shall be provided for each device supplied.

1.22 Current Transformers

The range of CT ratios and characteristics shall be in accordance with the requirements and values in the accompanying Schedules and as set out below.

Current transformers shall comply with BS 7626 except class X current transformers shall comply with last edition of BS 3938 and the requirements of 1.39.1 below.

All connections from secondary windings shall be brought out and taken, by means of separate insulated leads, to an accessible terminal board. Joints under compound in secondary leads shall be avoided, preferably by taking the leads to an adjacent terminal board above compound level.

Earthing and protection of current transformers and their associated connections shall be in accordance with the requirements of Engineering Recommendation S15 or EA Technical Specification 50-18, as applicable.
The specified particulars of the current transformers shall also be recorded on plate(s) mounted externally to the transformer chamber and readily visible when the equipment is in service. The plates shall not be fixed to removable covers.

The through current rating of CTs shall match the primary equipment rating. All CT secondary connections shall be brought out individually to a terminal block mounted external to the CT chamber to permit testing of individual CTs.

Incoming transformer equipments call for the supply of outdoor vertically mounted current transformers for use in 11 or 33kV transformer neutral connections. The current transformers shall comply with the requirements given in the schedules. In most instances two separate neutral current transformers are required and these shall be enclosed in a single outdoor weatherproof housing of the slip over type with an insulated sleeve fitted inside the bore between the neutral cable and the earthed portion of the housing. This insulation shall withstand 2kV ac to earth for 1 minute. The internal diameter of the bore through the housing shall be agreed at time of tender but shall in any event be not less than 55mm.

When required for instantaneous, unbiased, differential protection, current transformers may be specified to have a percent turns ratio error not greater than twenty-five times the ratio of the calculated primary fault setting to the assigned maximum through fault current.

The maximum knee point voltage shall not exceed the minimum by more than 50% for protection current transformers.

The highest knee point voltage of a current transformer forming part of a group of balancing current transformers for unbiased protection, shall not exceed the lowest by more than 20% of the lower value.

For example, this requirement applies to transformer differential earth fault protection where neutral and phase current transformers may be supplied under a separate contract.

The current transformer ratios and characteristics shall be as summarised herein, unless the current transformers are required to match those at existing substations for unit protection schemes.

FOR ALL UNIT PROTECTION AND PILOT WIRE SCHEMES THE MANUFACTURER SHALL SEEK DETAILS OF THE REQUIRED CT CHARACTERISTICS FROM THE PURCHASER PRIOR TO TENDER.

Type test certificates shall be provided if required by the purchaser.

Current transformer secondary windings shall have a bare wire diameter (copper) of not less than 0.8mm.

By agreement between the manufacturer and the purchaser, low energy output devices may be prescribed in lieu of CTs.
Current transformers shall be installed on the circuit side of the equipment in the following order starting adjacent to the circuit breaker:-

Main and back up
Control
Measuring
Busbar protection

1.22.1 **Class X CTs**

Current transformers, Class X, shall have a secondary current rating of 1A unless otherwise specified in the accompanying schedules, and a performance suitable for a wide application range. They shall provide accurate transformation up to the maximum fault current rating of the associated main plant and to ensure this performance under steady state conditions without undue saturation.

Where Class X current transformers are specified, these shall be to BS 3938 and the characteristics shall be submitted for APPROVAL prior to manufacture. A further exchange of information may be necessary at this point to match CT and relay characteristics to network requirements. They shall be designed to provide satisfactory relay performance over the full range of relay settings at the switchgear rated fault level. This shall apply to the lower ratio where dual ratio current transformers are specified.

1.22.2 **Metering Current Transformers**

A current transformer for use with metering equipment which may be precision grade or commercial grade. Metering current transformers shall have independent cores and secondary windings from those provided for protection purposes.

All metering current transformers shall be to BS7626 Class 0.5S rated at 15 VA unless otherwise specified in the accompanying schedules.

Where the rated circuit capacity exceeds 10MVA, WPD shall require metering current transformers to be of Class 0.2S accuracy. Such a requirement will be advised at time of enquiry and will be specified in the accompanying schedules.

CURRENT TRANSFORMERS SHALL BE TESTED TO CONFIRM COMPLIANCE WITH BS 7626 BUT SHALL ALSO BE ERROR TESTED ON EACH RATIO AT 7.5 VA 0.9 POWER FACTOR LAGGING BURDEN AT 5%, 20% 100% AND 120% TEST LOAD POINTS. THREE COPIES OF TEST CERTIFICATES SHALL BE PROVIDED, IN ADVANCE OF SWITCHBOARD DELIVERY, FOR EACH METERING CURRENT TRANSFORMER.

1.23 **Small Wiring and Ancillary Equipment**

The design and application of small wiring and ancillary electrical equipment shall be in accordance with the requirements of EA Technical Specification 50-18 and Engineering Recommendation S15 as applicable.
The small wiring shall be PVC insulated stranded copper size 7/0.67mm to BS 6231 Type B except that associated with telecontrol circuits. The insulation shall be coloured black in all circuits except earthing. All wiring shall be terminated with crimped connections in accordance with ESI Standard 12-2 depending on the terminal blocks used. Each end shall be ferruled with letters and numbers to BEBS - S12 and WPD Standard diagrams. All wiring circuits shall be treated as EA Technical Specification 50-18 Category I unless previously been agreed with WPD that Category II may be applied to certain specified circuits.

Terminal boards shall comply with ESI Standard 12-1. Care shall be taken that the mounting arrangement permits a screwdriver to be inserted in the spring loaded clamping screws of the insertion type terminal blocks. Spare cores shall be terminated at the terminal blocks furthest from the gland.

All fuse and link carriers and bases shall be in accordance with ESI Standard 50-18 and coloured as follows:-

2 amp)		
4 amp)		
6 amp)	Black	Colour 642 of BS 381C
10 amp	Grey	" 632 " "
15 amp	Green	" 216 "
Solid links	White or near White	

SEF	links	Lemon	"	355 "	"
Inst.	links	Blue	"	107 "	"

All fuses and links shall be logically and consistently grouped, on the front of the panel, to assist isolation and identification and shall be clearly labelled. All fuse cartridges shall be to BS 88, Part 1. For a.c. duties they shall not be less than category AC33 and for d.c duties not less than category DC40.

Where fuses and links are mounted vertically the incoming (supply side) shall be the bottom terminal.

Diagrams for all standard equipments shall be as set out in WPD standard diagrams.

All transducers, protection relays and interposing relays etc. are to be accessible for inspection, testing or change with the circuit breaker in its normal service position without the need for an outage.

On 36kV equipments a local/remote selector switch shall be provided for each circuit breaker equipment.

Wiring external to the circuit breaker equipment and the remote control switch or relay panel shall be provided by the purchaser unless otherwise specified.

1.24 Auxiliary Supplies

The control nominal voltage shall be 24V, 30V, 48V, 110V or 240V dc as specified in the accompanying schedules.
A fuse and link shall be provided in the positive and negative poles on each unit to isolate tripping circuits from d.c. bus wires. Fuses and links shall also be provided for control/closing circuits on each unit.

The motor supply for a circuit breaker mechanism shall be nominally 110V dc or 110V or 240V ac single-phase, or 415V three-phase, 50Hz as specified in the accompanying schedules.

For guidance on voltage limits refer to EA Technical Specification 50-18, Part 6.

1.25 Environmental Considerations for Outdoor Equipments

The environment, in the context of this Clause, relates to outdoor climatic conditions and vandalism considerations. The following requirements shall apply:-

(i) insulating systems shall be designed and materials selected to minimise deterioration of insulating and mechanical properties due either to the immediately surrounding environment or climatic conditions. Particular attention should be paid to the behaviour of insulation when immersed in oil containing moisture;

(ii) due regard shall be paid to the suitability of gasket materials used on any covers or doors that are subject to disturbance during normal operations.

Controlled compression gasketting is preferred. Designs shall be arranged to avoid ingress of water as a result of capillarity;

(iii) holes for cover or label fixing shall not communicate with any electrically stressed chamber;

(iv) care shall be taken in the design of external surfaces to avoid creating areas where wind-borne materials and water can lodge;

(v) the Company operating area is within exposed polluted coastal atmosphere according to BS 5493;

(vi) Tenderers shall suggest methods of minimising flashover risk due to wildlife eg birds.

1.26 **Filling Medium**

1.26.1 Equipment other than voltage transformers shall be of non-oil design.

1.26.2 Filling medium - oil.

Oil used in voltage transformers shall be to BS 148 and PCB free. Each oil filled chamber shall have its level clearly marked and labelled on an indicator glass.

1.26.3 Filling medium - gas.

The manufacturer shall specify the gas type, quality required operating density, etc, to be used in a gas-filled equipment and provide the purchaser with the necessary instructions for maintaining the quality of the gas and for renewing it when necessary.

Where a gas filling valve is provided it shall be a quick-acting coupling to ISO 7241-1 / BS 7198: Part 1: 1989 Series B Size 6.3, suitably protected to prevent inadvertent gas loss.

It is anticipated that SF6 will normally be to BS 5207 and that the dew point temperature in unheated SF6 filled equipment will not be higher than - 10 deg C at working gas density. Manufacturers shall advise if otherwise at time of tender.

Equipment shall be designed to minimise the possibility of leakage and the leakage rate shall not exceed 1% per annum.

Circuit breaker and switch equipments shall be provided with a two stage pressure switch where the first level provides indication when the pressure is slightly above minimum functional pressure and the second level operates when the pressure falls to the minimum functional pressure. Provisions for other gas filled compartments shall be agreed between manufacturer and purchaser at time of tender.

The equipment shall be designed to minimise the possibility of leakage. The leakage rate shall not exceed 1 per cent per annum of gauge pressure at 20-C.

1.26.3.1 Rated Filling Pressure

Refer to Sub-Clause 4.101 of BS 5227

1.26.3.2 Minimum Functional Pressure

Refer to Sub-Clause 3.126 of BS 5227

1.26.3.3 Design Pressure

Refer to Sub-Clauses 3.127 and 5.102.2 of BS 5227

1.27 Insulant and Compound

Liquid insulant for switch chambers shall not be supplied unless specified by the purchaser. However, any necessary gas filling shall be supplied.

1.28 Additional Routine Test

The fluid tightness of all equipment shall be confirmed.

1.29 Gas-filled Compartments

1.29.1 General

All gas-filled compartments containing switching devices etc, shall comply with the requirements of BS 5227. Means of over-pressure relief shall be provided. The design shall be such as to cater for the effects of an internal arc.

1.29.2 Type Test

See Sub-Clause 6.104 of BS 5227

1.29.3 Routine Test

See Sub-Clause 7.103 of BS 5227

1.30 Internal Arcing Fault Test Requirements for Metal-enclosed Switchgear

1.30.1 General

Tests are required and shall be made in accordance with annex AA of BS 5227 . Tests are only required for gas filled compartments containing mechanical switching devices.

1.30.2 Arcing Due to an Internal Fault in a Gas-filled Compartment

A type test shall be made on all gas-filled compartments containing mechanical switching devices. Typical arrangements are shown in figs 3 and 4. Arc initiation shall be in accordance with BS 5227. Clause AA.5.2.

If the application or the fusewire is not practicable it is permissible as an alternative to initiate the fault by other methods The method chosen shall be agreed between the manufacturer and the purchaser.

1.30.3 **Requirements Supplementary to annex AA of BS 5227**

(i) The duration or the test shall be 1 second.

(ii) The prospective test current (source side) shall be equal to the rated short-time withstand current, or the appropriate phase-to-earth current for phase segregated equipment used on solid, resistance or impedance earthed systems.

(iii) Accessibility Type A shall apply.

(iv) For outdoor metal-enclosed equipments the test arrangement shall simulate, equipment mounting and perimeter fencing.

(v) Criteria of acceptance.

The assessment of the Test of Appendix AA6 Criteria 1-6 inclusive shall be used to assess the tests for acceptance with the following additional requirements:

Criterion No 1

Doors, covers, etc, on the front surface must remain firmly attached.

Criterion No 2

Solid objects weighing more than 6 grams after flying off are considered such as to cause a hazard.

There shall be no visible mechanical perforation of the indicators.

(vi) Test Report Appendix AA7

Mounting height of the equipment to be recorded.

Note: In order to assist in assessment of test results the tests shall be filmed using two fast cameras with colour film. The cameras and tests shall be arranged in accordance with Figs 2, 3, and 4 when otherwise agreed. Camera 1 shall be adjusted for ambient brightness and have a film speed of approximately 500 frames per second. Camera 2 shall be adjusted for the brightness of an arc and have a film speed of approximately 2,000 frames per second.

1.31 **Transport and Storage Provisions**

(i) Any equipment shall be stable on its own supports during transit and storage. The requirement for returnable transit stands or stabilisers shall be avoided.

(ii) Due regard shall be paid to the prevention of water ingress whilst any equipment is in transit from the manufacturer's works.

(iii) The attention of the purchaser shall be drawn to any necessity to fill all insulant-filled chambers of outdoor switchgear with the specified. Insulant prior to storage outdoors. This also applies to all switchgear containing hygroscopic insulation which will be stored indoors for prolonged periods.

(iv) Exposed bushings shall be adequately protected from physical damage during transit and storage.

1.32 **Partial Discharge Tests**

Type and routine partial discharge tests shall be carried out in accordance with EA Technical Specification 41-18.

1.33 **Bushings**

Bushings shall be in accordance with the requirements of BS 223. Composite bushings have gas tight inner cores with replaceable insulating envelope are preferred for gas-filled equipment.

1.34 **Delivery, Erection and Commissioning**

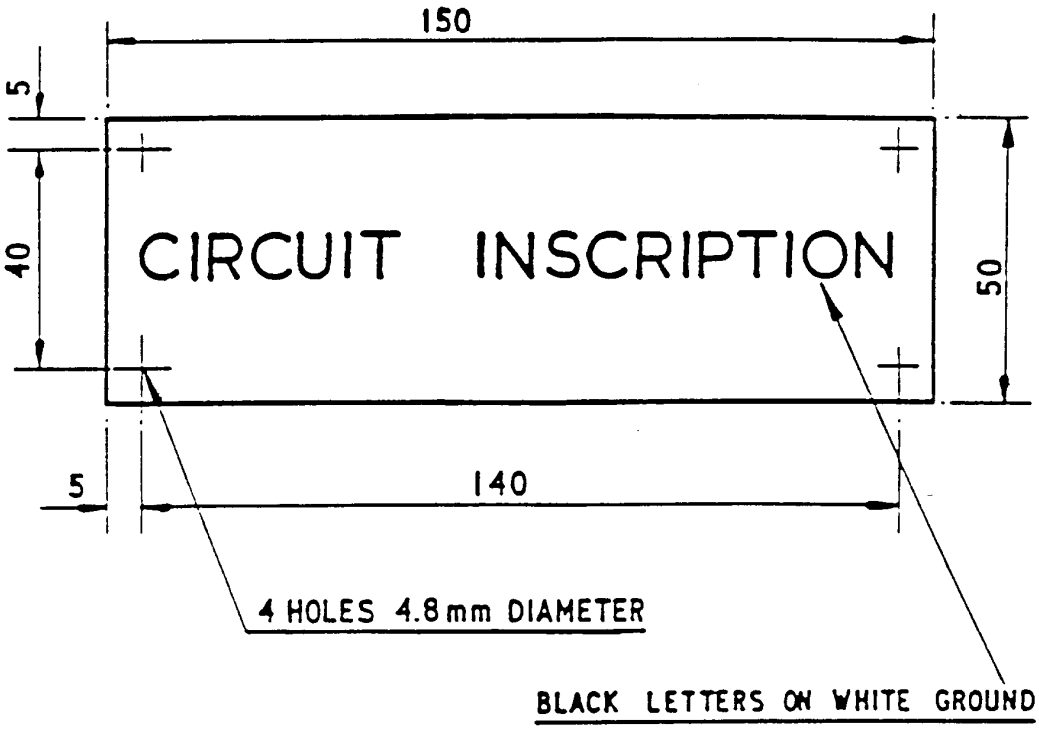
The Manufacturer shall deliver the gear to substation site or, if stated by the Company, designated store, and if required by the Company shall off load, erect and commission all equipment, included in this specification.

The erection will be on to concrete foundations prepared by the Company.

If specified at time of enquiry, WPD may require the manufacturer to carry out the main earthing and connection of the pieces of equipment to earth, also the supply, lay, gland off and terminate the multicore cables required between pieces of equipment.

The manufacturer shall ensure that his staff conform with statutory regulations when working on the Company's site. In addition they shall also observe the Company's Safety Regulations on sites which have been brought under the jurisdiction of the Safety Regulations.

These requirements may be subject to variation as detailed in the invitation to tender document.



El Drg. No. 410506

Fig. 1 Circuit Label

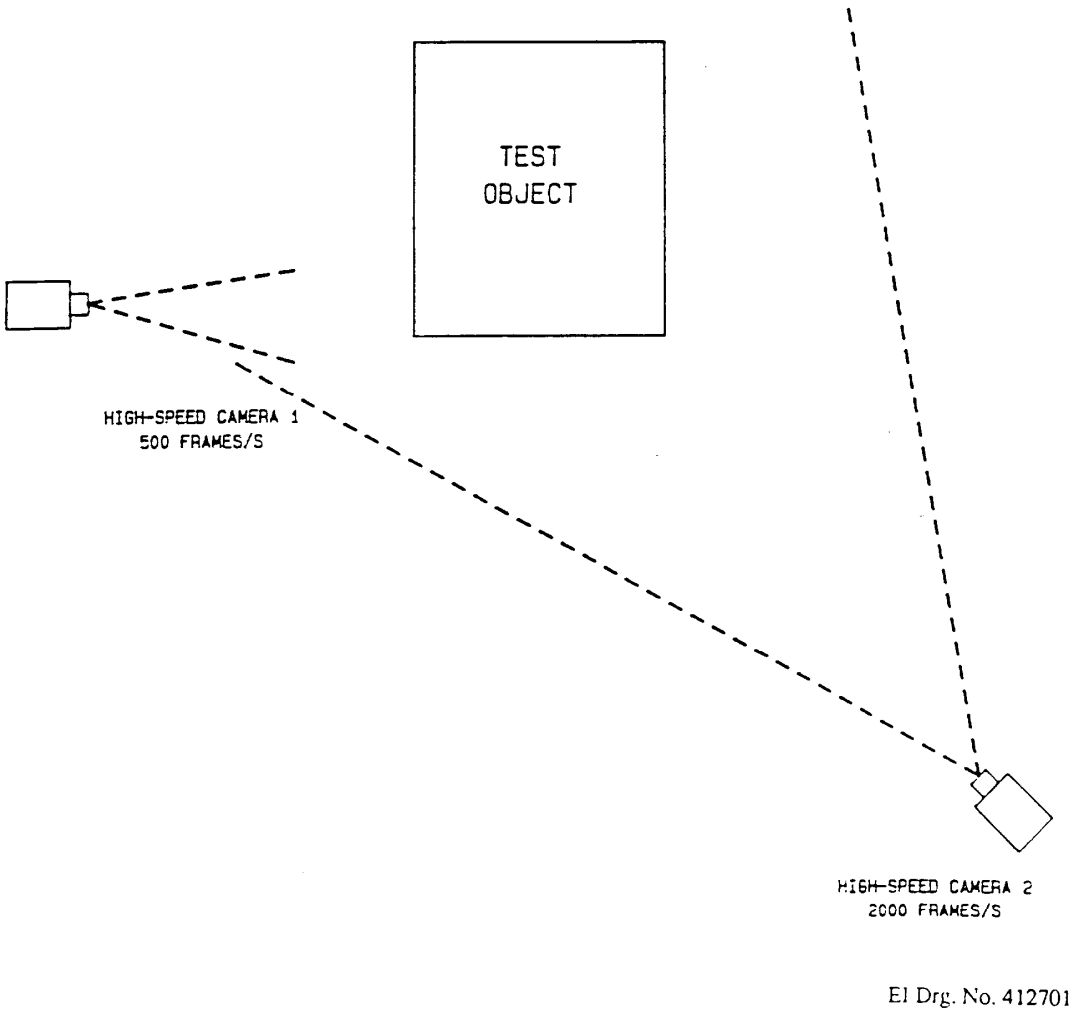


Fig. 2 Arrangement of High-speed Cameras

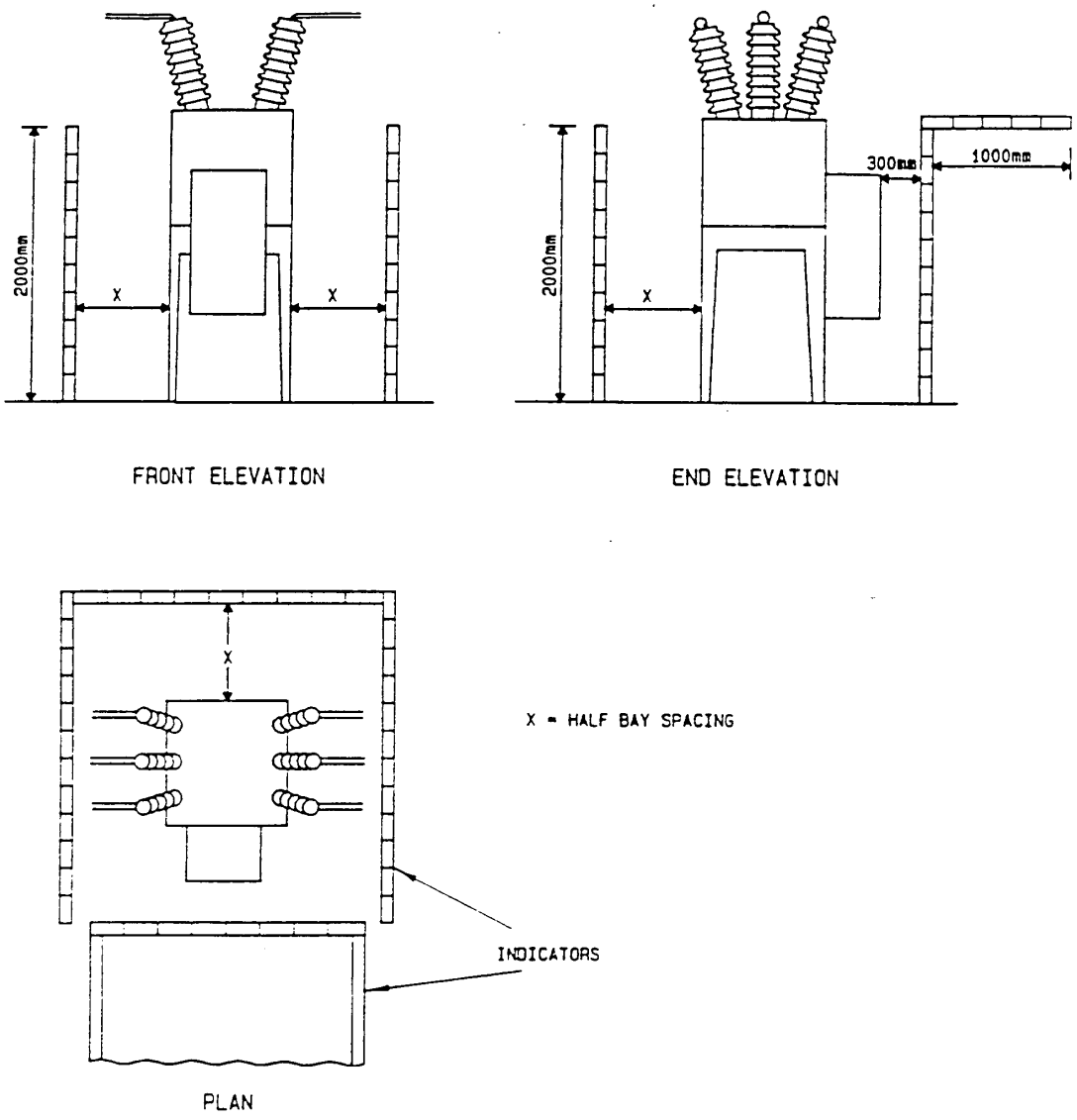


Fig. 3 Typical Test Arrangement for Overhead Connected Open Type Primary Substation

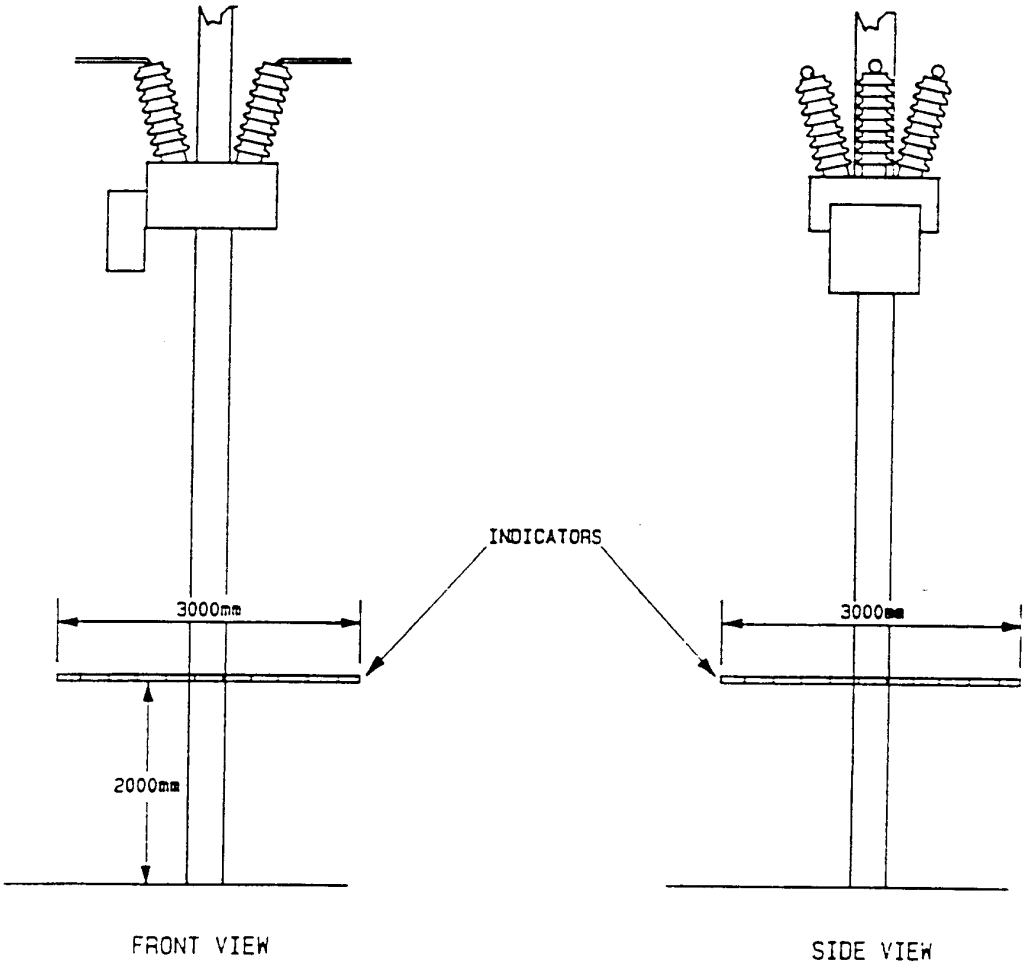


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Fig. 4 Typical Test Arrangement for Overhead Connected Pole-mounted Switchgear

Part 2 - Additional Clauses for Outdoor Ground Mounted Open Terminal Switchgear and Components for Outdoor Substations

2.1 General

This Part deals with the components of an outdoor substation. Much of the detailed requirements for these components is covered either by Part I of this Technical Specification or by one of the listed Standards. This Part only, covers requirements that are supplementary to the listed Standards.

2.2 Outdoor Open-terminal Circuit Breakers

2.2.1 Bushings

Where liquid-filled bushings are used, a prismatic gauge shall be provided and located so as to give a reliable indication from ground level on each bushing.

The design of bushings shall be such that space is provided for the accommodation of two current transformers. It is strongly preferred that it be possible to remove the current transformers without the need to withdraw the bushing from the circuit breakers.

Bushings shall be provided with plain unthreaded terminal stems and shall comply with the requirements of EA Technical Specification 41-16.

Arcing gaps shall be provided unless otherwise agreed prior to contract placement.

2.2.2 Control Facilities

Each circuit breaker shall be provided with facilities for remote operation, as well as facilities for local electrical and manual closing and tripping. The changeover switch for the electrical operation facilities, and a close/open control switch, shall be mounted at the circuit breaker.

Auxiliary switches shall comply with the requirements of EA Technical Specification 50-18. They shall be mounted so as to be readily accessible for maintenance.

2.2.3 Operating Mechanism Cabinet

An operating mechanism complying with the requirements of Clause 1.11 and of type XE, XEM or S as specified by the purchaser, shall be accommodated in a cabinet integral with the circuit breaker and provided with padlockable doors easily accessible from ground level. This cabinet shall comply with the requirements of EA Technical Specification 50-18 and shall be fitted with a heater or heaters for the prevention of condensation.

A mechanical ON/OFF indicating device shall he visible with the doors of the cabinet closed. The preferred position for the indicator is such that it can be seen from the front of the cabinet. Only one inscription shall be visible at any rime.

A circuit label in accordance with Fig 1 shall he mounted on the outside of the cabinet, and labels shall be provided inside the cabinet describing the functions of the various items of equipment, and giving the relevant details of the current transformers as specified in BS 7626.

A suitable number of terminal blocks shall be provided to accommodate the small wiring associated with the current transformers, multicore cables, the control, protection and indication circuits, together with a power outlet socket when specified by the purchaser.

2.2.4 **Additional Requirements for Oil Circuit Breakers**

Clauses deleted - no oil circuit breakers to be offered.

2.2.5 **Additional Requirements for Vacuum and SF6 Circuit Breaker Equipment**

2.2.5.1 **Contacts**

Where access to the circuit breaker contacts is not possible, or extremely complex, it shall be possible to determine whether the contacts have eroded so far as to require the circuit breaker to be taken out of service for contact replacement or its equivalent. See also clause 1.7.

2.2.5.2 **Operation Counter**

A counter shall be fitted to the mechanism of each equipment arranged to summate all the opening operations.

2.3 **Supporting Structure**

The supporting structure for the mounting of any of the components described in this Part shall be finished in accordance with Clause 1.18 and provide the clearances referred to in Clause 1.15.2.

The circuit breaker shall be complete on its own supporting structure, which may be constructed so as to split for convenient shipping to site, and arranged for ground mounting.

2.4 **Current Transformers**

See clauses 1.22.

All connections from secondary windings, including those intended for earthing, shall be brought out and taken by means of separate insulated leads to the terminal board referred to in Clause 2.2.3.

2.5 Voltage Transformers

2.5.1 General

2.5.1.1 Three phase oil insulated outdoor voltage transformers are required, naturally cooled and with outdoor bushing primary terminations equipped with arcing horns.

2.5.1.2 Voltage transformers shall be to BS 7625. Class 1.0 rated 100VA unless otherwise specified. *See 2.5.3 on metering VTs.

2.5.1.3 Voltage transformers for use on the 11kV system shall unless otherwise specified, be three limb star - star connected with the secondary neutral point brought out.

2.5.1.4 Voltage transformers for use on the 33kV system and five limb voltage transformers for use on the 11kV system, shall unless otherwise specified, be of five limb star - star - open delta connection with the neutral points of primary and secondary windings individually brought out to insulated external terminals. The secondary winding and residual voltage windings shall be wound for 63.5 V per limb and the transformer shall have a rated voltage factor of 1.9, 8 hours duration. Rated voltages shall be 33,000/110V or 11,000/110V.

2.5.2 Voltage Transformer Connections

2.5.2.1 The primary windings of each voltage transformer shall be connected to the primary conductors through fuse-links with current limiting features to BS 2692. Current ratings of fuse-links shall allow for magnetising inrush currents. A rating of 3.15A is preferred. The connections from the main circuit to the point of isolation of the voltage transformer shall have the same short time rating as the associated primary switchgear equipment.

2.5.2.2 The star point of the primary windings shall be brought out to an insulated external terminal. The Company will connect this terminal to earth on site. It is helpful for earthing purposes, if the primary star terminal and the tank earth stud are vertically in line, as a "link" connection can be made between the start terminal and the earth stud.

2.5.2.3 The secondary windings including open delta terminals shall be connected to the appropriate circuits through fuses and links, labelled to indicate their functions and phase colour to be marked in accordance with BS 5559. The neutral connection shall be connected via a bolted link.

Fuse/terminal boxes for mounting at low level on the VT Structure shall be provided. See Company Standard diagrams for arrangements. Note that the neutral of the secondary winding is earthed (and not the yellow phase).

Where VTs are used for Settlement Metering, separate fusing shall be provided for:

(a) Main metering
(b) Check metering
(c) Any additional burden.

The secondary windings shall be brought out to a tank-mounted terminal box mounted on the opposite side of the transformer to the HV bushings. These secondary terminals shall be marked a, b, c, n and da, dn in accordance with BS 3941. No fuses or earthing facilities are required in this terminal box.

The bottom of the terminal box shall be fitted with a weatherproof multicore gland to accept a 7 core 7/0.67mm cable in order to provide cabling to the low level terminal box as detailed.

2.5.3 VTs for Metering Purposes

Note that for settlement metering a second winding dedicated for metering is required. These may be connected as either:

(a) 1 dedicated winding for main and check metering, or

(b) 1 dedicated winding for main and a second for check, which may be shared with other burdens provided overall accuracy is met. The additional burden must not be changed without approval of the Settlement System Administrator.

In the case of voltage transformers used for metering purposes, individual test certificates shall be provided. Voltage transformers used for metering customers supplies shall be to BS 7625 Class 1.0 unless otherwise specified in the accompanying schedules and shall be error tested by the manufacturer.

Where the circuit capacity exceeds 10MVA, WPD require metering VTs to be of class 0.5 accuracy; this will be advised at time of enquiry.

ALL METERING VT TEST CERTIFICATES SHALL BE TESTED TO CONFIRM COMPLIANCE WITH BS 7625 BUT SHALL ALSO INCLUDE ERROR TESTS ON RED/YELLOW AND YELLOW/BLUE AT 10VA 0.5 POWER FACTOR LAGGING BURDEN. THREE COPIES OF THE TEST CERTIFICATE SHALL BE PROVIDED PRIOR TO DELIVERY. FOR OTHER VOLTAGE TRANSFORMERS TYPE TEST CERTIFICATES SHALL BE PROVIDED IF REQUIRED BY THE PURCHASER.

2.5.4 Voltage Transformer Fittings and Mountings

Each transformer shall be provided with the following fittings:-

Suitable earthing stud
Lifting lugs
Oil filler plug
Oil level gauge
Rating and diagram plate

In addition, the total weight of the transformer shall be marked on the tank.

Where a breathing device is fitted, this shall be of a weatherproof design and shall be of a silica gel type. This device shall be mounted on extended pipework to permit its changing from ground level.

The transformer tank shall be provided with base drillings in accordance with drawing numbers SM121 and SM122 to permit the transformer to be bolted to the VT structure.

2.6 Current Voltage Transformer Requirements

Clause deleted.

2.7 Terminations, Conductors and Fittings

2.7.1 General

Terminations, conductors and fittings shall comply with EA Technical Specification 41-16 and clearances shall be in accordance with Clause 1.15.2.

2.7.2 Busbar Phase Centres

Busbar phase centres for 36kV shall preferably be 1220mm.

2.8 Interlocking

When specified, a key interlock, located within the operating cabinet and of a type approved by the purchaser, shall be provided for the interlocking of the circuit breaker and its associated disconnecters and earthing switches. The interlock on the circuit breaker operating mechanism shall be designed so that the key of the interlock is trapped when the circuit breaker is in the closed position and is released (without any further operation being required) when the circuit breaker is in the open position. Attempted removal of the key from the circuit breaker mechanism when the circuit breaker is closed shall not trip the circuit breaker. It shall not be possible to close the circuit breaker unless the key is inserted and turned in the interlock. The key shall be supplied with the circuit breaker.

2.9 Control and Relay Panels

2.9.1 Construction

2.9.1.1 Where relay panels are specified these shall be wall supported relay panels, extending down to floor level, to enable part of the weight of the panel to be supported by the floor unless otherwise specified. These panels shall comply with ESI 50-18, and be Ambient Class I unless otherwise specified.

2.9.1.2 In order to allow panels produced by different manufacturers to be fitted adjacent to one another, WPD prefer these panels to have specified fixed dimensions and these shall be, 2000 mm high, 760 mm wide and 500 mm deep. WPD standard general arrangement drawings are available on request.

2.9.1.3 Provision shall be made for buswiring between panels. End panels shall have provision for future extension and any holes which will not be used initially shall be blanked off.

2.9.1.4 Again, for standardisation, the preferred arrangement is that the interpanel cut out for buswiring shall be 100 mm wide, 50 mm wide centred 100 mm forward of the rear face of the panel and 1500 mm above floor level. The earth bar interpanel cut out shall be 30 mm wide, 60 mm high centred 50 mm forward of the rear face of the panel and 100 mm above floor level. (In order to permit side by side installation of various panels.)

2.9.1.5 All doors shall open within the width of the cubicle to allow panels to be butted up against one another.

2.9.1.6 The relay panel and door shall be constructed from sheet having minimum thickness 3mm, and bracing shall be provided as necessary to prevent whipping.

2.9.1.7 When free standing Control/Relay cubicles have been specified, they shall be of the bottom entry free standing cubicle type with rear opening doors and shall comply with ESI Standard 50-18 unless otherwise specified. The equipment shall be designed and constructed to operate in Ambient Class I environmental conditions.

2.9.1.8 All relays with the exception of auxiliary relays without flag indicators and supervisory relays, shall be mounted on the front panel. All relays and instruments mounted on the front panel shall be flush mounted, the relays being of withdrawable pattern.

2.9.1.9 Relays shall be positioned so as to ensure free access to all relay terminals without disassembly.

2.9.1.10 The door shall be fitted with two fastening handles only one of which need be lockable.

2.9.1.11 The cubicles are to be designed for bottom entry of multicore cables. The gland fixing arrangement shall be such that other glands may be added at a future date without the need to disturb the wiring of the existing cables. If the gland fixing arrangement does not form an effective anti-vermin barrier within the cubicle, then an anti-vermin barrier shall be fitted below the gland position, giving facilities for additional multicore cables to be easily installed when required.

2.9.1.12 The exterior and interior of the cubicles shall be coloured light grey, colour reference 631 to BS381C - semi-gloss.

2.9.2 **Control/Relay Panel and Kiosk Earthing**

2.9.2.1 An earth bar of not less than 25mm x 3mm copper shall be provided internally with bolted connections between adjacent cubicles. The earth bar shall be provided with means to connect the earthing of small apparatus within the cubicle.

2.9.2.2 All metal bases of relays, etc. shall be earthed directly to the earth connection by means of an insulated wire of cross section not less than 2.5m². The wire colour shall be green/yellow. The disconnection of any one piece of apparatus from earth shall not disconnect any other apparatus. Normally this shall be ensured by ring

wiring. Earthing is not required for components with a body of insulating material or for apparatus or components enclosed in a non removable insulated case or cover or for apparatus or components when used in circuits at a normal voltage of 110V.

2.10 Relays and instruments

2.10.1 **Where specific makes and types of relays, transducers, terminals, fuses and links are shown in the accompanying schedules, alternatives which can be demonstrated by the Tenderer, at time of tender, to be equivalent may be acceptable subject to agreement <u>prior</u> to placement of Contract.**

2.10.2 Relays for tripping and control duties shall meet Class 1 performance of EA Technical Specification 50-18, and relays for auxiliary circuits shall meet Class 2 performance of EATS 50-18.

2.10.3 Auxiliary relays, eg Clifford & Snell, shall be mounted on bases having side access for wiring and front access retaining screws.

2.10.4 Attention is drawn to the requirement in Clause 1.7 above, for proposed means of measuring cumulative I^2t duty on circuit breakers.

2.10.5 Where alternatives are accepted, the Tenderer shall supply equivalent Application Drawings to those already in use by WPD.

2.10.6 Instruments are to be supplied in accordance with EA Technical Specification 50-18, Part 5.

Scaling: Ammeters shall be scaled in accordance with the associated current transformer as follows -

2.11 Multicore Cables

The manufacturer shall provide multicore cable glands to accommodate multicore cables in accordance with ESI Standard 09-6.

2.12 Transducers, Interposing Relays, Switches etc for Telecontrol

See Appendix D.

2.13 Drawings

To be in accordance with WPD standard circuit diagrams relevant copies of which will be provided to the Contractor.

The manufacturer shall produce the following drawings:-

(1) Circuit diagrams for both ac and dc connections for each circuit.

(2) Wiring diagrams for each circuit together with overall bus wiring diagrams.

(3) Multicore schedules.

(4) General arrangement for the switchgear *

(5) General arrangement for relay/control cubicles *

(6) General arrangement for bus zone panels *

(7) Switchgear - foundation drawings *

* Note - equipment schedule shall be included on these drawings.

The drawings shall be prepared in accordance with Section 7 of Part 2 of ESI Standard 50-18 and shall not exceed A1 size.

Drawings 4, 5, 6, 7 shall be submitted by the manufacturer with his tender.

All drawings shall be submitted for approval within two months from the time of commencement date of the contract or by a mutually agreed date at the placement of the contract.

The manufacturer shall supply 3 copies of each drawing for approval. When approval has been obtained a further 4 copies of each drawing shall be supplied.

After construction and commissioning the manufacturer shall incorporate any alterations in these drawings, which have occurred during site work and these shall be completed within 3 months from the return of the drawing for correction. After these corrections are complete the manufacturer shall provide final drawings in CAD format using one of the media options for transferring files as shown in Appendix E unless otherwise agreed prior to placement of contract.

2.14 **Year 2000 Conformity**

Equipment must meet the requirements of BSI Disc PD-2000-1 on Year 2000 Conformity.

Part 3 - Additional Clauses for Pole-Mounted Enclosed Switchgear

3.1 General

This section details pole-mounted enclosed switchgear for use in rural networks with remote control and/or automation schemes or simply for local operation. These include auto-reclosing circuit breakers *(pole-mounted auto-reclosers - PMARs* or *reclosers)*, switches eg earthing or sectionalising switches *(sectionalisers)*, switch disconnectors and disconnectors. Reclosers with an integral disconnector are also covered by this section.

The switchgear may be filled with oil or gas (including air) for insulation and gas or vacuum may be used for current interruption.

The common clauses of Part 1 of this specification apply except where modified by the following clauses common to all pole-mounted enclosed switchgear.

3.1.1 Ratings

Ratings shall normally be selected from Table 5, but alternatively the ratings of Table 6 may be offered.

Table 5 IEC values of rated voltage, rated impulse voltage, normal and short-time currents

			Rated impulse level	
Rated voltage	**Rated normal current**	**Rated short-time current**	**Phase to earth**	**Across isolating distance (1)**
12kV	315, 630A	6.3 or 12.5kA	75kV 95kV (3)	85kV 110kV (3)
36kV	315, 630A	6.3 or 12.5kA	170kV	195kV

Refer to IEC 694 Table 1a series 1.

Table 6 Other preferred values of rated voltage, rated impulse voltage, normal and short-time currents including those from ANSI

			Rated impulse level	
Rated voltage	**Rated normal current**	**Rated short-time current**	**Phase to earth**	**Across isolating distance (1)**
12kV	200, 250, 400, 560, 630A	6 or 12kA	ANSI 110kV	ANSI 125kV
36kV	400, 500, 630A	6, 8 or 12kA	ANSI 170kV	ANSI ?

Refer to ANSI/IEEE C37.63 and C37.60

(1) The increased power frequency and impulse voltage withstand only applies to switching devices where the clearance between the contacts, when in the open position, is designed to meet the safety requirements specified for disconnectors.

(2) Tenderers of gas filled equipment incorporating disconnectors, shall state the rated performance at minimum functional pressure of 0 bar (gauge). It is preferred that the equipment is also able to withstand 1.5 times rated voltage at 0 bar (gauge) when filled with air.

3.1.2 **Mounting arrangements**

The equipment may be mounted in the following arrangements:

(i) 'Pole top' version (ie control box fixed to or adjacent to the switching unit).

(ii) 'Mid pole' version (ie control box within the Safety Clearance zone, but above the anti-climbing guard).

(iii) 'Down the pole' version (ie control box at a level suitable for manual operation or easily accessed by an insulating ladder or folding platform).

Switching units shall be supplied complete with mounting bracket and arranged for mounting on a single wood pole or substation structure. Control/auxiliary cables running down a pole shall be protected by a suitable guard against damage by cattle or vandals.

For Types (ii) and (iii) arrangements it shall be possible to mount the control box on the opposite side of the pole to the switching unit.

3.1.3 **Means of operation**

3.1.3.1 **Manual**

The switching unit shall be capable of manual operation from ground level by high or low level actuation as detailed in Clause 4.2.1 as appropriate to the performance duties required of the unit, and options selected by the Company.

Units designed for low level actuation shall permit remote operation by retrofitting a device such as an actuator or motor operated device.

The only means of operating any integral earthing switch shall be by a manual operating rod and handle as specified in clause 3.7.

3.1.4 **Power**

When appropriate the switching unit shall be capable of power operation from ground level low level actuation as detailed in Clause 4.2.1 and options selected by the Company.

The unit shall usually derive its power supply from one of the following sources as requested by the Company.

(i) Two phases of incoming HV overhead supply (ie uni-directional).

(ii) Two phases of HV normal incoming and alternative overhead supplies (ie bi-directional) = Preferred Arrangement.

(iii) Battery - sources of power supply are the same as those for auxiliary power supplies detailed in Clause 3.6.

An operation counter shall be fitted, positioned so as to be visible from ground level.

3.1.5 **Integral operating rods and handle mechanism**

An operating rod shall conform to the requirements of Clause 4.2.2 and incorporate an insulated insert.

The preferred convention for manual operating handles is:

w for vertical longitudinal movement - upwards to close (ON) and downwards to open (OFF)

w for horizontal torsional movement - left to right to open (OFF)

The preferred mounting height of the handle, at its centre line, shall be 1200mm above ground level, and in any operating position the grip of the handle shall be between a minimum of 750mm and 1700mm above ground level.

The rod and handle shall be manufactured from galvanised mild steel or other suitable weather-resistant material providing adequate mechanical strength. The handle and lower portion of operating rod shall be effectively connected to earth, and a flat surface drilled to accept two M12 fasteners shall be provided for this purpose. All external operating rods etc shall be designed to prevent water accumulation and ice load affecting performance. (Ice expansion in hollow rods has previously forced out rod clamps and lead to failures).

Operating handle and rod shall be designed for mounting on wood, steel, aluminium or concrete supports.

Operating handles shall incorporate an arrangement to ensure stability of the mechanism, such as an 'over-toggle' device or similar, when the operating handle is in either the open or closed position. They shall incorporate padlocking facilities.

Open and closed indication shall be incorporated in the switching unit, labelled in accordance with Table 4. The height of the letters shall not be less than 20mm. Only the appropriate ON or OFF shall be visible at any one time.

3.1.6 **Auxiliary power supplies to control box**

Power supplies required by the switching unit's control or ancillary equipment eg RTU may be derived from one of the following battery sources:

1. Non-rechargeable battery independent of external supplies. Operating life preferably shall not be less than 10 years.

2. Continuous charge maintained battery supplied from:

   (i) an internal supply

   w VT

   (ii) an external supply:

   Note: *there may be a risk of dangerous transferred touch potential for some of the following arrangements and precautions need to be considered.*

   w LV ac supply
   w capacitor charged from HV overhead line
   w dc supply eg substation
   w pole-mounted power transformer or VT

Where equipment is, or is planned to be, telecontrolled, auxiliary supplies shall always be via one of the methods specified in (2) above.

Batteries shall be accommodated outside any gas zone and be easily replaceable.

Means shall be provided to check remaining battery life. A label shall be fitted inside the door of the control box identifying the manufacturer, type and chemistry of the battery fitted, highlighting any safety precautions and disposal instructions necessary.

3.1.7 **Auxiliary Transformer**

Where a rechargeable battery supply is provided the ac supply may be provided from:

w an external voltage transformer to BS 7625, standard voltage range, of sufficient capacity - typically between 100 and 500VA.

w small capacity pole mounted transformer generally to EATS 35-1.

3.1.8 **Telecontrol**

Accommodation shall be provided in the control box for interfacing equipment (RTU) and that required for remote communication or, at the purchasers request, provide facilities for terminating connections from separately housed telecontrol equipment.

The telecontrol accommodation shall be provided with suitable environmental control e.g. heating to prevent deterioration due to environmental conditions. A heater is preferred.

The following shall be provided:

- w Options for communication - telephone modem, private mobile radio, mainsbourne signalling or other on request by the purchaser.

- w Open protocol for SCADA remove communication to IEC 870.

- w Facility to use DNP3 protocol via an RS 232 serial port.

3.1.8.1 The following SCADA lists required functions for pole mounted reclosers. Similar functions are applicable on other switchgear.

Operation: Open, Close*
Auto reclose sequence in, out
Protection enable, disable
SEF Protection enable, disable
* cold load pickup shall be initiated for 5 seconds following close operation

Indication: Open, closed
Auto reclose in, out
Protection in, out
SEF protection in, out
Recloser locked out (automatic sequence completed)
Successful reclosure completed
SEF trip
Low SF6 gas pressure alarm

For switches, provision <u>also</u> of fault passage indicator operation.

The above indications only to be reported on completion of switching sequence.

Alarms related to communication and power supplies. Note, the outputs from these alarms may be combined with the low SF6 gas pressure alarm to signal a general "maintenance" alarm but means shall be provided on site to determine which one has initiated the alarm.

3.1.9 **Degree of Protection**

The degree of protection shall be not less than IP34 to BS EN 60529 for all enclosures. The facia of the control box with the door open should adequately resist inclement weather eg driving rain. Down pole enclosures shall be vandal resistant and be equipped with means of padlocking using a WPD supplied padlock having a 7mm diameter hasp.

3.1.10 **Earthing**

To safeguard operators during earth faults pole-mounted switching units and control boxes shall be bonded and earthed in one of the following manners. For each method of earth connection appropriate testing of the unit will be necessary to prove voltage withstand against any possible potential rise.

The control box and switching unit shall be equipped with an M12 earthing terminal in accordance with Clause 1.17.1. Conductors connected to ground earth should be covered or capped to provide insulation up to a height of 2 metres.

(a) **Method 1**

The control box shall be suitable for connecting direct to earth via an earth 'mat' under the operator's feet at the bottom of the pole or structure and not via the switching unit at pole top. The earthing conductors from the switching unit and control box shall be positioned for maximum separation between them (eg opposite sides of the pole or structure) and be not less than 150mm. The armouring or screen of the 'umbilical' connection should be earthed at the control box end only and insulated at the switching unit. The earthing arrangement shall be as shown in WPD (SWEB) Overhead Line Manual 43-89/23.

(b) **Method 2**

Used with equipment operable only by insulated portable operating rods. Because it is not usually practical to provide an adequate level of insulation for auxiliary circuits from the pole top unit, equipment shall be carefully arranged on the pole so that no metal part can be touched while standing on the ground. This requires manual operation by using an approved insulated operating rod eg a hookstick, or by mounting the control box at sufficient height to need to leave the ground and use an insulated ladder or platform.

(c) **Method 3**

Used with air break switch disconnectors with manual operating handle at ground level. Uses separate earth mat connected to operating handle with 9m segregation from HV steelwork earth. As shown in WPD (SWEB) Overhead Line Manual 43-89/11.

3.1.11 **Terminals**

Screwed terminals in accordance with EATS 41-16 "Apparatus Termination Specification" shall be provided unless otherwise agreed.

When requested by the purchaser a 10mm dia tinned copper spigot shall be provided for connecting live line taps and connected directly to the each incoming and outgoing terminal.

3.1.12 **Lightning protection**

Facilities shall be provided for mounting lightning surge arresters as close as possible directly to each side of the switching unit as required by the Purchaser. This distance should not exceed 5m. The arresters should be insulated from any steel support and a separate earthing connection run preferably to ground level ensuring maximum separation to any umbilical control cable, but as a minimum to be joined to the common earth below the control box. The earthing conductor should be run as straight as possible.

Alternatively, lightning arresters may be mounted on a separate cross arm, both of which are earthed via a common conductor.

3.1.13 **Live Line Installation**

Manufacturers shall state what special requirements if any apply to erection of the equipment supplied by live line techniques eg sequence of making main connections, earthing, battery switch on etc.

3.2 **Auto-reclosing circuit breakers**

3.2.1 **General**

There are no completely satisfactory Standards existing for the equipment required. The American National Standards Institution (ANSI) Standards C37.60 and C37.63 contain the main information which, taken together with the addition of no-load opening and closing operations before and after short circuit tests, a 3-second short-time current test, values of prospective TRV and lightning impulse tests according to BS 5311, define an equipment which is acceptable. The design aspects shall generally comply with BS 5311 and the short-circuit performance levels with ANSI/IEEE C37.60 or C37.63 as appropriate, and in all other respects BS 5311 shall apply.

3.2.2 **Type tests**

The following type tests shall be performed:

- w short circuit tests to ANSI/IEEE C37.60.
- w short-time current (3 second), dielectric (power frequency and lightning impulse) and temperature rise tests to BS5311.
- w no-load closing and opening operations before and after short-circuit tests.
- w short-time current test.
- w agreed values of prospective TRV.

3.2.3 **Loss of Source Voltage**

The recloser shall incorporate facilities for selecting:

(i) Latched to close.

(ii) Latched to remain open.

The 'latched to close' version enables an open recloser to close immediately when the source voltage is re-established. The 'latched to open' version remains open when the supply is restored. Reclosers shall be supplied set with latched to remain open.

3.2.4 **Protection and Control**

The number of trips to lockout under phase fault, earth fault or sensitive earth fault conditions shall be adjustable in the range 1 to 4. Each trip in the sequence shall be adjustable to be either an instantaneous or delayed trip.

It shall be possible to carry out and to subsequently restore the following control functions from ground level with the equipment in service, by access to the control box or by portable insulated operating rods (ie hook stick).

(i) Trip and lock out.

(ii) Close.

(iii) Lock in the closed position.

(iv) Select protection settings (3 position selector is preferred for facilities marked *):

- w auto-reclose ON ie normal automatic sequence *
- w inhibit auto-reclose (A/R OFF)/one instantaneous trip to lockout *
- w inhibit auto-reclose and instantaneous protection (A/R OFF/INST OUT) ie IDMT trip only *
- w inhibit sensitive earth fault (SEF OUT) - when specified by the Purchaser

For control boxes mounted at or near bottom of pole the following facilities shall also be available with the equipment in service:

(i) Local/remote control switch.

(ii) Indicate loss of gas pressure.

(iii) Provide means to check remaining battery life.

(iv) Option of capability to store history of 10 (minimum) previous trip sequences.

(v) contact wear/remaining life indication required from cumulative current counting eg I^2T.

Reclosers shall be provided with a multi-characteristic protection relay having the following characteristics available:

Standard inverse
Very inverse
Extremely inverse
Definite time

Overcurrent, earth fault and sensitive earth fault (SEF) protection must also be provided. Sequence co-ordination (for connecting reclosers and automatic sectionalisers is series) is required.

With auto reclose sequence selected out (ie selection of "one trip to lockout") it must be possible to set overcurrent and earth fault protection to instantaneous and SEF protection to a delayed operation.

A control to lock the recloser in the closed state shall be provided.

Protection arrangements on other equipment shall be described in the tender.

Where separate control boxes are utilised these shall be provided with an umbilical permitting bottom of pole mounting.

Other

Details shall also be provided at time of tender on:

- recloser/sectionaliser dead time settings - to be selectable from at least 1 to 30 seconds
- reclaim times available - to be selectable from at least 5 to 30 seconds
- provisions for current counting
- mounting and earthing arrangements, including mountings for surge arresters
- numbers of permitted operations at various fault levels before maintenance is required
- maintenance requirements and availability for WPD to maintain
- materials and surface coating systems including surface preparation coating system and dry film thickness
- copy of O&M manual including details of protection and control

3.3 Switches and Switch Disconnectors

3.3.1 Switches and switch disconnectors shall comprise Class E3 general purpose switches as defined in IEC 265-1 *with the addition of 10 make on faults*.

The clauses of Part 3.1 are applicable with the following additions:

3.3.2 **Control and indication**

For control boxes mounted at bottom of pole the following facilities shall be available with the equipment in service:

(i) Local/remote control selector switch.

(ii) Gas pressure indicator.

(iii) Low or loss of gas pressure indication/alarm.

(iv) Provide means to check remaining battery life.

(iv) Indicate overcurrent and earth faults via internal current transformers. Adjustable setting range of 2 - 16% E/F and 10 - 240% O/C.

3.4 **Sectionalisers**

3.4.1 **General**

Sectionalisers shall have the same short time rating making capacity and normal load breaking current as the associated reclosers.

Sectionalisers shall comprise switches, switch disconnectors as appropriate to the performance duties required of the unit. *If a switching duty is required the electrical endurance shall be to Class E3 and mechanical endurance to Class M1* general purpose switches as defined in IEC 265-1.

The clauses of Part 3-1 are applicable with the following additions:

3.4.2 The automatic sectionaliser in the closed position, shall be capable of counting 'pulses' of fault current produced by the close-open operations of an associated 'upstream' auto-recloser. After the number of pre-programmed pulses has been reached the sectionaliser shall be arranged to open during the dead time of the auto-recloser.

If the fault is cleared before the prescribed count is reached, the sectionaliser fault current 'pulse' counter will reset so that it is at zero when the next fault occurs.

The sectionaliser pulse count shall be immune to magnetising inrush current.

Facilities shall be provided for locally closing the sectionaliser after opening. This will be done from ground level. Similar facilities shall be available for manually tripping the sectionaliser and padlocking in the open position.

Installations employing sectionalisers equipped with Current Transformers shall be provided with means of shorting the secondary connections, located in the base of pole control/communication cabinet. (Note – this will require co-ordination between suppliers of the respective items).

Part 4 - Additional Clauses for Air-Break Switch Disconnectors, Disconnectors and Earthing Switches

4.1 General

This Part deals with air-break switch-disconnectors, disconnecters and earthing switches mounted on supports and operated from ground level.

Two groups of switch-disconnectors are specified:-

(i) **Group A**

Switch-disconnectors in which the current is broken on main contacts or arcing contacts which move in unison with the main contacts.

These are covered by this Technical Specification.

(ii) **Group B**

Switch-disconnectors fitted with self-contained arc extinguishing devices (eg interrupter heads).

The characteristics of this device are covered by BS 5463.

Equipment shall be designed to permit the addition of an earthing switch to BS 5253.

4.2 Operating Mechanisms

4.2.1 General

Equipment shall be capable of operation from ground level by one or more of the following types of mechanism (see Part 1 Clause 1.11) appropriate to the making capacity of the switch and as selected by the purchaser.

(i) **Type, DM**

(a) **Low Level Actuation**

An integral operating rod directly coupled to a handle for manual operation, attached to the support.

(b) **High Level Actuation**

A lever at the upper end of the support coupled to the equipment, designed so that it can be operated by a portable insulating rod which shall be in tension during closing and opening operations. The link from the equipment to the lever shall be in tension during an opening operation.

(ii) **Type SE**

An integral operating rod coupled to a mechanically stored energy, mechanism and handle, attached to the support.

(iii) **Type M**

An integral direct motor drive.

4.2.2 **Integral Operating Rods**

When specified by the purchaser, the operating rod shall be supplied complete with an insulating insert capable of withstanding a wet 1 minute voltage test of 2.5 times the rated phase to earth voltage of the switch-disconnector. The insert shall be positioned so that its lower end is a minimum of 3m above ground level when the operating rod is at its lowest operating position.

Where a single rod is used to transmit longitudinal movement it shall be in tension during the opening operation.

All operating rods etc shall be designed to prevent water accumulation and ice load affecting performance. (Ice expansion in hollow rods has previously forced out rod clamps leading to failures).

4.2.3 **Operating handle Mechanism**

Operating handles moving in the vertical plane shall normally move upwards to the closed (ON) position and downwards to the open (OFF) position. For torsionally operated rods the movement of the handle in the horizontal plane shall be from left to right to the open position. Operating handles shall incorporate an over toggle or similar arrangement to ensure stability of the switch-disconnector when the operating handle is in either the open or closed position.

The preferred mounting height of the handle at its centre line shall be 1200mm above ground level, and in any operating position the grip of the handle shall be between a minimum of 750mm and a maximum of 1700mm above ground level.

The handle and any mechanism enclosure shall be manufactured from mild steel or other suitable weather-resistant material providing adequate mechanical strength. All metalwork in the vicinity of the handle, including the lower end of the operating rod, shall be effectively connected to earth, and a flat surface drilled to accept two M12 fasteners shall be provided for this purpose.

Operating handle mechanisms shall be designed for mounting on wood, steel or concrete supports.

4.2.4 Marking of Operating Handles and Mechanisms

Operating handles and mechanisms shall be provided with clear identification of open and closed positions. Labels shall be provided in accordance with Table 4.

The height of the letters shall be not less than 10 mm.

Only, the appropriate position ON or OFF shall be visible at one time.

4.3 Ratings

Ratings of air-break switch-disconnectors for overhead line mounting are given in Table 8.

Ratings of 36kV disconnector and earthing switches for use in ground-mounted substations, shall be selected from Table 1 in Part 1 of this Specification.

4.4 General Design

Single-pole units comprising a disconnector or switch-disconnector shall be one of the following types:

(i) Three insulator, rocking
(ii) Three insulator, rotating
(ii) Three insulator, pusher

Single-pole units shall be designed for ganged operation.

4.5 Mounting Arrangements

4.5.1 Overhead Line

Units shall be designed for mounting on standard crossarm steelwork to ENA Technical Specification 43-95 for 12kV. For 36kV mounting arrangements shall be supplied with the tender.

4.5.2 Other 36kV Equipment

The base of each single phase disconnecter shall be drilled in accordance with Fig 5 to permit universal fixing when assembled as a three-phase unit. Where specified by the purchaser, supporting galvanised steelwork for a three-phase unit shall be provided.

4.6 Support Insulators

See Part 1 Clause 1.14. These shall be manufactured from either porcelain or toughened glass or composite, as specified by the purchaser. Porcelain & Composite insulators may be of either the cylindrical post type or pedestal post type. Toughened glass insulators shall be of the pedestal post type.

Page amended 17th September 2014

Insulators for 36kV substation equipment shall be suitable for use with a disconnecter in the upright, horizontal or underslung position.

4.7 Contacts

Main fixed and moving contact shall be self-aligning and shall be manufactured from suitable high conductivity material. High conductivity copper shall be to BS 2874. Unless otherwise agreed, contact surfaces shall be silver or nickel faced, such that a layer remains at the point of contact after the breaking and mechanical endurance tests.

Where spring loaded devices are used these shall be manufactured from corrosion resistant materials compatible with the contact. Where separate springs are used, these shall not be part of the current carrying circuit. Shrouds may be used where necessary to maintain spring action under ice conditions but must not act as a trap for moisture, nor inhibit free air circulation.

Secondary contacts such as arcing horns and flicker blades shall be so arranged that they do not impair the short-circuit making capacity of the switch-disconnector. This will normally be achieved by ensuring that the arc extinction devices come into operation only on the opening of the main contacts.

4.8 Flexible Leads and Connections

Flexible leads, forming the main current carrying path of rocking / pusher type switch-disconnectors shall be of multi-strand, high conductivity, annealed copper conductors preferably covered for long-term protection against abrasion and corrosion. If the covering is PVC it shall be black, 0.8mm radial thickness to BS 6746, Table 1, Type 4. The leads, terminations and supporting apparatus shall be so arranged and connected to provide mechanical stress relief at the connections. Compression lugs shall be manufactured from high conductivity electrolytic copper to BS 2874 and generally in accordance with EA Technical Specification 43-92.

The leads shall be either supported by an apparatus, or so designed to provide adequate clearance between groups of leads and moving parts of the switch and to result in minimum wear of both the leads and their covering.

Flexible connections of rotating type devices and shunt connections shall be either multi-strand type or laminations of high conductivity copper strip to BS 4608, each strip tinned with a minimum thickness of 15mm (BS classification SN6C), generally in accordance with BS 1872.

4.9 Bases

The base of each pole of the disconnecter shall be manufactured from mild steel to BS 4360 Grade 43A or cold rolled steel to BS 2994. Other materials may be used by agreement with the purchaser.

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4.10 Ganging Arrangement

The separate poles of a disconnecter, switch-disconnector or earthing switch shall be ganged together by means of a coupling shaft, so that all poles of a ganged assembly shall operate together.

4.11 Bearings

Bearings shall be of a type incorporating a long-life material having a low coefficient of friction and shall not require lubrication after installation.

4.12 Padlocking Facilities

Operating handles or operating devices shall be secured in position in accordance with BS 5463. Provision shall be made for locking all operating handles or operating devices in both the OPEN and CLOSED positions from ground level by means of a padlock. Where the switch-disconnector is operated by a portable insulated rod, the padlocking arrangement shall be agreed with the purchaser.

4.13 Nameplates

Weather-proof and corrosion-proof nameplates shall be provided on each pole of the equipment and on the operating mechanism and shall contain the following information.

4.13.1 Disconnector

(i) Disconnector to EA Technical Specification 41-36
(ii) Manufacturer
(iii) Rated voltage
(iv) Rated normal current
(v) Rated short-dmc current

4.13.2 Switch-disconnector

(i) Switch-disconnector to EA Technical Specification 41-36
(ii) Manufacturer
(iii) Group designation (A or B)
(iv) Rated voltage
(v) Rated normal current
(vi) Rated short-time current
(vii) Rated short-circuit making capacity

4.13.3 Earthing Switch

Rating plate to BS 5253: 1975, Clause 35.

4.14 Type Tests

Disconnectors and earthing switches shall be type tested to BS 5253.

Switch-disconnectors using self-contained arc extinguishing devices shall be type tested to BS 5463 as general purpose switches Class 1, except that their fault-making duty may be limited to that specified for a switch-disconnector in Table 6 of this Specification.

Other switch-disconnectors to this Technical Specification shall be type tested generally in accordance with BS 5463 except as modified by Table 7 of this Specification. When carrying out breaking capacity tests for Group A disconnectors it is suggested that the master circuit breaker opening initiation should be at least 2 seconds after the short circuit initiation.

4.15 Design Clearances

4.15.1 General

The design shall ensure that any flashover is to earth rather than across the isolating gap and arcing horns may be used for this purpose providing the specified impulse withstand levels are still met.

4.15.2 36kV Equipment

Phase centres shall preferably be 1220mm.

4.16 Additional Requirements for 36kV Disconnectors Associated with Circuit Breakers

4.16.1 Interlocks

When specified by the purchaser, a single key interlock corresponding to that in the associated circuit breaker (See Part 2 Clause 2.8) shall be provided so that the key is released only when the disconnector is in the fully open or fully closed position. The key will be supplied with the circuit breaker.

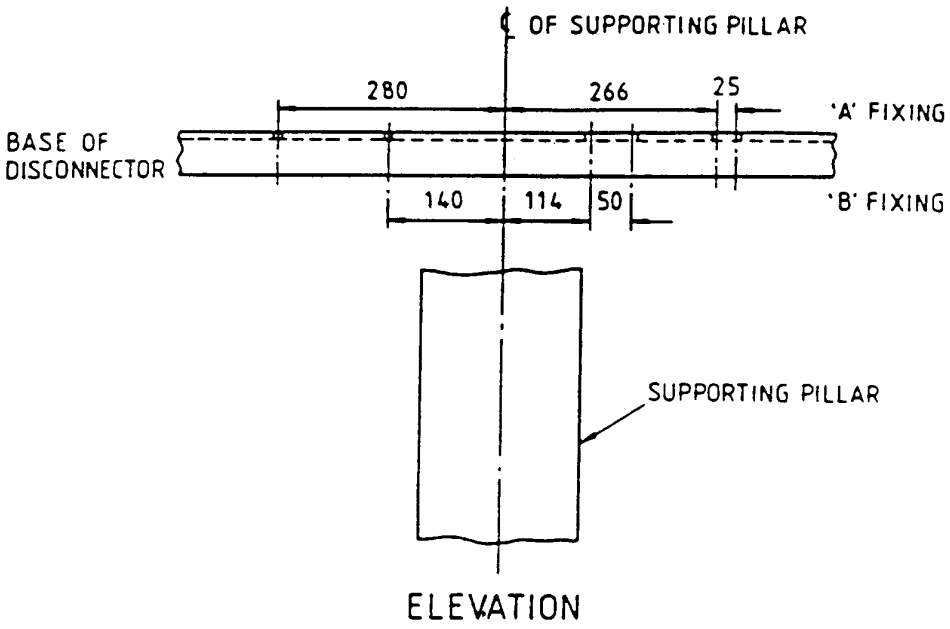
4.16.2 Auxiliary Switches

Provision shall be made for the ready addition of auxiliary switches giving a three-pole change-over contact arrangement. Switches when specified by the purchaser shall be housed in a box with adequate wiring space and a suitable cable gland.

Table 7 - Modifications to BS 5463 Type Tests

Type Test	Requirements	Remarks
Cold Temperature Tests (including icing)	Mechanical operations of the switch-disconnector at -10ºC with 5mm thickness of ice formation at the contact system	Performance to be satisfactory without damage to contact system (switch left in ambient conditions until switch reaches same temperature)
Switching Tests (in sequence) Duty Cycle 1 (c-t-0_1-t-c-t^1-0_1) (i) Peak Making Current	2 operations at peak short-circuit making capacity	No change or repair of contacts between operations
Duty Cycle 2 (o-t-o-t...o) (ii) Rated Mainly Active Load Breaking	10 operations at full-load rating at 0.7 PF	Following the peak making test (i), if required by the manufacturer, specified renewable parts may be renewed before commencement of test (iii). Tests (ii) to (v) inclusive to be carried out without change or repair of contacts. After (i) and (ii) switch shall carry rated active load current without exceeding the specified temperature limit.
(iii) Transformer Off-load Current Breaking	20 operations at rated value	
(iv) Cable-charging Current Breaking	20 operations at rated value	
(v) Closed Loop Breaking	10 operations at rated value at 0.3 PF at 10 per cent of system rated voltage	

Where: c is at the rated short-circuit making capacity.
o is at the appropriate rated breaking capacity.
t and t^1 are time intervals convenient to the test plant.
0_1 no load opening operation



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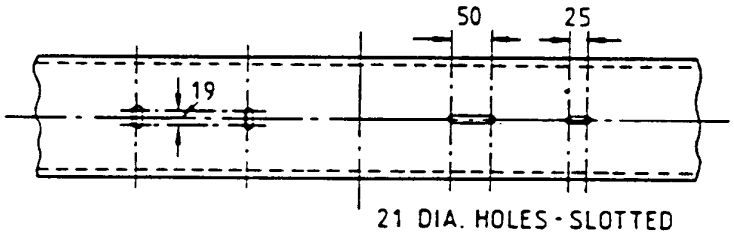
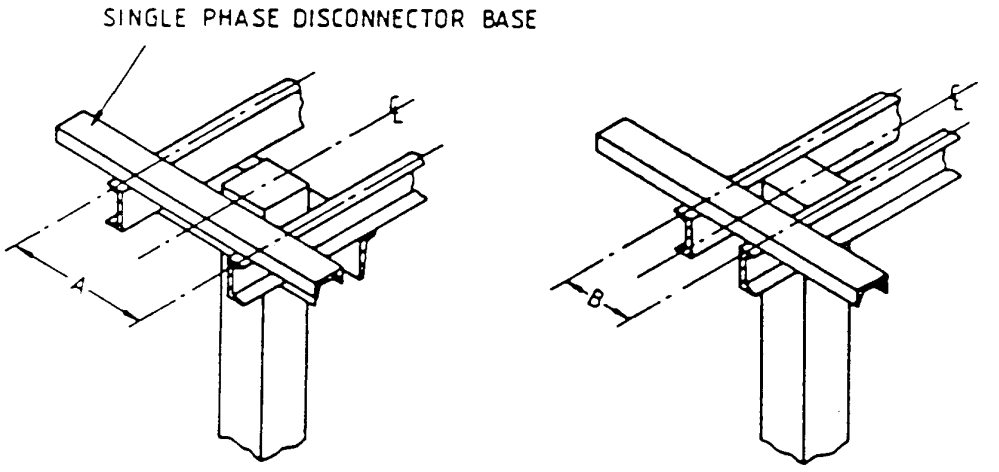


PLAN



DIMENSIONS IN MILLIMETRES

EI Drg. No. 412704

TYPICAL MOUNTING ARRANGEMENTS

Fig. 5 - Universal Drilling in 33kV Disconnector Base

4.17 Additional Requirements for Earthing Switches

Each earthing switch shall have the same short-time current rating as its associated disconnector, and shall be interlocked with it by means of mechanical or key interlocks, the former being preferred. The earthing switch shall have an operating mechanism and mounting height similar to the associated disconnector but the positions shall be labelled 'EARTH ON' and 'EARTH OFF'.

4.18 Finish

All ferrous parts of disconnectors and earthing switches, including the drives and operating mechanisms, etc, shall be galvanised in accordance with Part 1 Clause 1.18.3 after fabrication and machining.

Alternatively, for ground-mounted equipment, subject to the approval of the purchaser, operating mechanisms may be zinc sprayed and painted in accordance with Part 1 Clauses 1.18.1 and 1.18.2.

Table 8 - Ratings of Air-break Switch-disconnectors for Overhead Line Mounting

Voltage (kV) Ur		**12**		**36**	
Insulation Level (kV)					
Lightning Impulse Withstand Voltage					
To earth and between poles		75		170	
Across terminals of open switch-disconnectors (peak)		85		195	
1 Minute Power Frequency Withstand Voltage (rms)					
To earth and between poles		28		70	
Across terminals of open switch-disconnectors		32		80	
Normal Current (A)		400 or 630 or 800		400 or 630 or 800	
Short-time Current (3s) (kA)		12.5		12.5	
Short-circuit Making Capacity (kA)					
Dependent Manual Operation (DM)		3 (7.5 Peak)		3 (7.5 Peak)	
Other than Dependent Manual Operation		10 (25 Peak)		10 (25 Peak)	
	Group	A	B	A	B
Breaking Capacity:					
Mainly Active load-breaking (A) I_{load}*		20	400	10	400
Closed Loop (A) I_{loop} *		300	400	300	400
Cable-charging (A) I_{cc} *		5	10	5	20
Line-charging (A) I_{lc} *		1	1	2	2
Transformer Off-load (A)		5**	6.3	2**	6.3

* Taken from Table 6.1 Values of rated breaking currents for air-break switch disconnectors in ENA TS 41-36. However at times of tender I_{cc} Type Tests should be evaluated against ENA ETR 137, Clause 7 Enhanced Value of Cable Rated Cable Charging Breaking Current.

** Where it is more convenient to measure the peak value of transformer off-load current, this shall not be less than three times the specified rms value.

Page amended 6th November 2014

Breaking Capacity of Switch-Disconnectors fitted with Self-Contained Arc Extinguishing Devices (Interrupter Heads)

Where switch disconnectors (fitted with interrupter heads) are specified the following rating and breaking capacity shall apply:-

Normal current	400, 630 or 800 Amps
Mainly Active Load-breaking	400 Amps
Closed Loop	400 Amps
Transformer Off-load	6.3 Amps
Cable Charging	10Amps @ 11kV, 20Amps 33kV

4.19 **Interlocks**

On substation disconnectors and earthing switches associated with feeder and bus-section circuit breakers, the interlocks to be provided shall be Fortress Type H31/LH/AC 65º.

On those associated with incoming transformer circuit breakers, either Fortress or Castell interlocks shall be required, the make and type to be designated by the Purchaser at the time of placing an order or contract.

Page amended 17th September 2014

Part 5 - Additional Clauses for Expulsion Fuses, Solid Links and Automatic Sectionalising Links

5.1 General

Pole-mounted fusegear is used widely to protect distribution transformers and HV overhead circuits and to provide means of isolation for operational purposes. Automatic sectionalising links and solid links are used in place of fuse carriers in drop-out fuse mounts and consequently these links and mount combinations are required to have a rated short-time withstand current value adequate for circuits controlled by circuit breakers equipped with IDMTL protection.

All combinations are used with dependent manual operation, within the limits specified, to disconnect live circuits and to energise circuits believed to be healthy.

5.2 Definitions

5.2.1 Drop-out Expulsion Fuse

An expulsion fuse to BS 2692 Pt 2 incorporating a fuse mount and fuse carrier which is disengaged automatically by operation of a fuse to form an isolating gap and can be operated as a disconnector by means of a portable operating rod.

5.2.2 Drop-out Automatic Sectionalising Link

An equipment providing the isolation facilities of a drop-out expulsion fuse instead of a fuse carrier incorporating a device designed to disengage automatically, in a dead period after detecting a predetermined sequence of fault currents.

5.2.3 Solid Link

A non-fusible link providing the isolation facilities of a drop-out expulsion fuse when substituted in place of a fuse carrier.

5.3 Normal Service Conditions

Equipment shall be suitable for use under the minimum ambient conditions in Clause 1.4.

5.4 Ratings and Tests for Complete Equipments

5.4.1 All Combinations of Expulsion Fuses, Links, Carriers and Mounts

Complete equipments shall comply with BS 2692 except that requirements for rated breaking capacity, shall not apply, to automatic sectionalising links and solid links.

The main rated quantities derived from BS 2692 are summarised:-

Voltage	kV	12	24	36
Rated Current (with fuse)	A	100	100	100
Breaking Capacity (Three-phase symmetrical)	kA	8.0	6.3	4.0
Impulse Withstand Voltage	kV	See Clause 1.5		

5.4.2 **Automatic Sectionalising Links and Solid Links**

The following ratings shall be applicable to complete equipments incorporating Automatic Sectionalising Links and Solid Links:

Rated Characteristic	**Applicable Type Test**	**Value**
Normal Current	BS 2692 Clause 12	200A solid links See Clause 5.5.3.2 for automatic sectionalising links
Peak Current and Short-time Current	BS 5253 Clause 39	10kA peak 4kA rms for 3 seconds
Lightning Impulse Voltage Withstand	BS 6581 Clause 4.2.1	Table 1 List 2

5.4.3 **Expulsion Fuse-links**

Each fuse-link shall be subjected to a tensile test with 100N applied. The resistance of the fuse-link shall be measured after test and shall be within ±10% of manufacturer's data.

5.5 **Drop-out Automatic Sectionalising Links**

5.5.1 **General**

This section applies to single-phase, electronically controlled, drop-out, automatic sectionalising links for use in purpose built mounts, or in mounts designed for ganging in two-phase or three-phase sets with a common mechanical linkage to provide isolation of all phases when any one automatic sectionalising link operates. In general, the sectionalising links will be designed to he physically, interchangeable with the fuse carriers of drop-out expulsion fuses. However, such links may also be designed for specific use in purpose-built mounts. The links are designed to recognise a predetermined sequence of fault currents and then, during a period when the upstream protective device is open, to disengage and drop-out to the isolating

position. The performance requirements of the mounts, whether purpose built or common expulsion fuse mounts, in terms of dielectric tests and insulation properties are to be in general conformance with the appropriate requirements of BS 2692: Part 2.

5.5.2 **Definitions**

5.5.2.1 **Minimum Actuating Current**

The threshold current in amperes above which the sectionalising link commences operational sequence.

5.2.2.2 **Reclaim Time**

The period of time in seconds, starting when the line current has fallen to a value below the minimum actuating current for the sectionalising link to reclaim its original predetermined number of main current pulses from any part of an incomplete sequence.

5.5.2.3 **Hold-off Current**

The minimum line current in milliamperes below which the sectionalising link infers that the upstream protective device is open.

5.5.2.4 **Actuator**

A replaceable device designed to eject a pin from its body, when activated by a suitable current, with sufficient energy output and travel to ensure disengagement of the automatic sectionalising link from its mount.

5.5.3 **Operation Parameters**

5.5.3.1 **Minimum Actuating Current Setting**

The value shall be selected from the following standard values:

25; 40; 63; 100A; 160; 200A

5.5.3.2 **Maximum Load Current**

The maximum steady load current for a given minimum actuating current shall be declared by the manufacturer.

Note:

This value will normally, be governed by, the degree of immunity, which the automatic sectionalising link has to transformer magnetising inrush current.

5.5.3.3 **Voltage Rating**

Automatic sectionalising links shall be marked to indicate dimensional suitability for use in mounts of a particular voltage rating or class.

5.5.3.4 **Reclaim Time**

The nominal reclaim time shall not exceed 25 seconds.

Note:

It is recognised that reclaim time may vary as a function of overcurrent value and duration.

5.5.4 **Labelling of Automatic Sectionalising Links**

Automatic sectionalising links shall be marked with the following information, which may be in coded form identifiable from the manufacturer's catalogue.

(i) Automatic sectionalising link to EA Technical Specification 41-36
(ii) Manufacturer
(iii) Rated voltage
(iv) Minimum actuating current
(v) Maximum load current
(vi) Reclaim time
(vii) Numbers of counts to operate

5.5.5 **Type Tests of Automatic Sectionalising Links**

All tests shall be carried out using a stated design of mount which shall be in a new clean condition.

5.5.5.1 **Operational Tests**

This series of tests to be carried out on three sample automatic sectionalising links. The tests relate to automatic sectionalising links programmed to operate after sensing two impulses of current above minimum actuating current level within the reclaim time. Automatic sectionalising links programmed to respond to 3 or more pulses of current, while not covered by these tests may also be tested by employing the same general principles, but with the stated number of current pulses modified as appropriate.

(i) Apply a current of value 0.8 times minimum actuating current ±5% for a duration of 1.0 second ±0.1 second. Apply a second similar pulse of current after 3.0 seconds ±0.1 second.

The automatic sectionalising link shall not operate.

(ii) Apply a current of value 1.2 times minimum actuating current ±5% for a duration of 1.0 second ±0.1 second. Apply a second similar pulse of current

after an interval corresponding to between 1.5 - 2.0 times stated reclaim time.

The automatic sectionalising link shall not operate.

(iii) Apply a current of value 1.2 times minimum actuating current ±5% for a duration of 0.1 second ±0.02 second. Apply a second similar impulse of current after an interval corresponding to between 0.4 and 0.6 of the stated reclaim time.

The automatic sectionalising link shall operate.

(iv) Apply a current of 4kA rms symmetrical for a period of 0.1 second ±0.02 second. Apply, a second similar pulse of current after an interval of time corresponding to between 1.5 and 2.0 times the stated reclaim time.

The automatic sectionalising link shall not operate.

(v) Apply a current of 4kA rms symmetrical for a period of 0.1 second ±0.02 second. Apply a second similar pulse of current after an interval of time corresponding to between 0.4 and 0.6 of the stated reclaim time.

The automatic sectionalising link shall operate.

(vi) Repeat sequence (iii) but with a value of current, following the end of the second current impulse without a break, equal to between 2 and 3 times the value of the hold-off current.

The automatic sectionalising link shall not operate.

Repeat test sequences (i) to (vi) a total of 3 times on each of the three sample automatic sectionalising links.

Allow a period of time equal to 3 times the reclaim time between each test of (i), (ii), (iii) etc.

5.5.5.2 **Short Time Current Test**

Apply 4kA rms symmetrical for a duration of 3 seconds ±0.1 second. Then repeat test sequence (i), (ii), (iii) on the same sample.

The automatic sectionalising link shall operate correctly and shall not suffer any, damage likely to impair its further use in service.

Note: The value and duration of the short-time current test values are partly covered by the corresponding capability of the associated mount.

5.5.5.3 **Degree of Protection**

Equipment shall provide a Degree of Protection of IP33.

5.5.5.4 **Special Tests**

Tests for high frequency, disturbance withstand, corrosive atmosphere, salt-laden mists and other environmental hazards are not specified here but may be agreed as appropriate between manufacturer and user.

5.5.5.5 **Performance Characteristics**

The manufacturer shall make available on request the following data:-

(i) Variations of reclaim time with value and duration of actuating current.

(ii) Variation of minimum actuating current and reclaim time with variations in ambient temperature over the range -25 to +70ºC.

5.6 Construction

Equipments shall be designed for manual operation using insulating operating poles not less than 4.8m long inclined at an approximate angle of 15º to the vertical. The operations required are: insertion, removal, opening and closing. The maximum force applied to the link via the operating pole during closing is 150 N.

Gaps between live and earthed metalwork of complete equipments shall be adequate to avoid short circuit by the presence of the operating pole head.

Fuse carriers, solid links and automatic sectionalising links after being inserted and hanging freely shall be interlocked against disengagement at the pivot during closing operations. They shall be provided with an operating eye or hook to facilitate engagement of the operating pole head from the front.

Fuse carrier disengagement mechanisms shall accommodate tolerances in fuse-link length which can be expected to arise from installation and service without causing significant reduction in contact pressure or latch engagement.

Automatic sectionalising links shall be constructed to be at least as robust and corrosion free as the fuse carriers they are designed to replace. Where automatic sectionalising links are designed for use with more than one type of fuse mount, detailed instructions of any adjustments required shall be included with each unit. Actuators shall be designed for easy replacement in the field without use of specialised tools.

5.7 Mounting Arrangement

The equipment shall be suitable for mounting on the 102mm web of a channel or equivalent surface having one or two 14mm fixing holes located with centre line 45mm from the upper edge. Single hole fixing arrangements shall have provisions to prevent fuse mount swivelling.

5.8 **Terminals**

Terminals complete with studs or bolts and nuts with plain and lock washers shall be suitable to accept either a lug with single hole palm, 14mm hole or alternatively to clamp hard drawn stranded copper conductor 3/0.147.

Part 6 - additional Clauses for 36kV Fault-Throwing Switches

6.1 General

This Part deals with 36kV single-pole fault-throwing switches and their supporting structure.

Fault-throwing switches may be either for phase to earth or phase to phase operation as specified by the purchaser, and shall be horizontally mounted and in accordance with BS 5253 unless otherwise agreed.

6.2 Ratings

The rating of fault-throwing switches shall be 20kA for 3 seconds and a peak making capacity of 40kA.

6.3 Operating Mechanism

The operating mechanism shall be type DM/XE.

For resetting the switch to the open position a 'free handle' mechanism shall be used and during this operation the closing spring shall be automatically charged. A push button external to the mechanism box with provision for padlocking shall be provided for closing the fault-throwing switch manually.

The operating handle shall be provided with padlocking facilities in accordance with Part 1 Clause 1.16. The operating rod shall be fitted with an insulating insert near the top of the rod.

The switch shall be normally closed by the electrical release of a mechanical latch. The closing time shall not exceed 400ms.

A label shall be provided giving clear operating instructions for opening the switch and charging the springs.

6.4 Operating Mechanism Box

The mechanism shall he accommodated in a padlockable box meeting the requirement of EA Technical Specification 50-18 for Ambient Class II.

Contact position indication showing ON or OFF shall be visible from the front of the box with the door closed.

The trip coil shall be 110V DC unless otherwise specified.

A heater or heaters shall be fitted.

A minimum of 5 auxiliary switches shall be provided, comprising 2 normally open and 2 normally closed switches driven from the fault-thrower contacts and one switch driven from the closing springs and closed when the springs are charged.

Where necessary, external moving parts shall he guarded so as to prevent danger to operators.

6.5 Interlocking

When specified by the purchaser electrical or mechanical interlocking shall be provided for operation or maintenance requirements.

6.6 Supporting Structure

The supporting structure for the fault-throwing switch shall be finished in accordance with Part 1 Clause 1.18 and provide the clearances stated in Part I Clause 1.15.2. WPD drawings SMGA4 and SM38 show concrete structure mounting arrangements required. All fixings for mounting the fault throwing switch to this mounting shall be provided with the switch.

6.7 Terminations, Conductors and Fittings

Terminations, conductors and fittings shall comply with EA Technical Specification 41-16.

6.8 Cable Connection

When specified by the purchaser accommodation shall be provided for the termination of a 400 sq mm cable.

Island layer insulation of the cable gland shall be provided.

The cable termination shall not be used as part of the switch structure.

6.9 Release Circuit Monitoring

When specified by the purchaser release circuit monitoring shall be supplied. This shall be a non-adjustable wire wound ceramic coated resistor of a specified ohmic value and provided with robust terminals.

ADDITIONAL TYPE TESTING REQUIRED ON CIRCUIT BREAKERS INTENDED FOR AUTO-RECLOSING DUTY ON 11kV AND 33kV DISTRIBUTION NETWORKS

This Appendix specifies the additional three-phase type testing required on certified 12kV and 36kV circuit breakers intended for auto-reclosing duty at 12.5kA, 16kA, 20kA, or 25kA short-circuit levels. The required ratings are set out in the accompanying schedules.

For Pole Mounted enclosed switchgear see also Part 3 of this specification.

A.1 GENERAL

Circuit breakers being considered for auto-reclosing duty shall already have been certified to BS 5311: 1988 and the Certificate of Rating shall be made available.

Circuit breakers shall be tested to prove the ability to perform one of the four performance levels at the rated short-circuit breaking current and a Report of Performance obtained. Estimation of the performance of the circuit breaker at current values below the tested level shall be in accordance with established methods.

By agreement between manufacturer and purchaser alternative means of demonstrating suitability for auto reclose duty may be acceptable.

A.2 PERFORMANCE SPECIFICATlON

A.2.1 Short-circuit Performance Levels

Four Performance Levels are given. The purchaser shall select the appropriate Performance Level. The rated operating sequence is defined as O - 0.3s - CO - 3'- CO.

Performance Level	Operating Sequence	Total Number of Three-phase Rated Breaking Current Operations
1	Rated	3
2	Rated plus two additional CO - t - CO	7
3	Rated plus seven additional CO - t - CO	17
4	Rated plus twenty-two additional CO- t- CO	47

A 2.2 Breaking Time

The break time preferably should not exceed 100ms.

A.3 TYPE TEST SPECIFICATION

A.3.1 General

The specification is based on the Rated Operating Sequence in BS 5311: 1988 with additional sequences to prove compliance with a declared Performance Level.

A.3.2 Test Specification

A.3.2.1 Short-circuit Tests

Short-circuit testing procedure shall be carried out in accordance with the requirements of BS 5311:1988.

The following additional requirements shall be observed:-

(i) during testing no modifications shall be made to the circuit breaker under test;

(ii) oscillograms of all test sequences shall be recorded and evaluated;

(iii) the test sequence(s) shall be as specified below. The rated short-circuit breaking current shall be as stated in Part 1 and in the accompanying schedules.

(iv) test sequences shall commence with (a) 0-0.3s* - CO-3min-CO. * This value may be up to O.5s to allow for mechanism reset times. Additional sequences comprising (b) CO-t-CO where t = 20 +/- 10s shall be carried out at intervals not exceeding 5 minutes (except as permitted below) to prove the required Performance Level;

(v) any inspection between test sequences shall be as short as practicable; no adjustments or replacements are permissible. As appropriate, a monitoring inspection which may exceed the 5 minutes specified above is permissible after 7 breaking operations, 17 breaking operations and once at an intermediate point between 17 and 47 breaking operations;

(vi) the CO-t-CO sequence shall not be subdivided into its respective operating duties;

(vii) in the event of the 5 minute interval defined above being exceeded due to problems on the test plant the test series shall not necessarily be invalidated. Action under these circumstances is left to the discretion of the Testing Authority;

(viii) a short-time current test at rated short circuit breaking current shall be applied for a period of 3s following the final CO-t-CO sequence. The circuit breaker shall be able to trip freely after this test;

(ix) where access to the circuit breaker contacts is not possible or extremely complex the breaker shall withstand a power frequency 1 minute test across

the contacts at the conclusion of the tests. The applied voltage shall be in accordance with Table 1 of IEC 694.

This test may also be used during the monitoring inspections defined above

A.3.2.2 **Mechanical Operation Tests**

A report of a mechanical operation test carried out in accordance with BS 5311: 1988 Table XII is required.

The report shall be made available for examination when requested by the purchaser.

A.4 CIRCUIT BREAKERS CERTIFIED TO BS 116: 1952

Circuit breakers certified to BS 116: 1952 may be considered for auto-reclosing duty by agreement between the purchaser and the manufacturer and tested to prove compliance with a declared Performance Level.

Auxiliary Switches

Auxiliary switches shall comply with ESI Standard 50-18.

The following circuit breaker, and spring mechanism auxiliary switches shall be provided:-

Solenoid Mechanisms

All Feeder Breakers

1 N/O for trip coil
1 N/O for Auto reclose
1 N/C for Auto reclose
1 N/O for remote indication
1 N/C for remote indication
1 N/O for supervisory indication
1 N/C for supervisory indication
1 N/C late opening for solenoid contactor
1 passing contact for common alarm
1 N/C for trip supply supervision
2 N/O spare
2 N/C spare

Incoming Transformer Units

1 N/O for trip coil
1 N/O for auto reclose
1 N/C for auto reclose
1 N/O for remote indication
1 N/C for remote indication
1 N/O for supervisory indication
1 N/C for supervisory indication
1 N/C for voltage transformer supply supervision
1 N/C late opening for solenoid contactor
1 passing contact for common alarm
1 N/C for trip supply supervision
1 N/O for trip supply supervision
2 N/O spare
2 N/C spare

Bus Section Units

1 N/O for trip coil
1 N/O for remote indication
1 N/C for remote indication
1 N/O for supervisory indication
1 N/C for supervisory indication
1 N/C late opening for solenoid contactor

1 passing contact for common alarm
1 N/C for trip supervision
8 N/O for VT supervision
4 N/C for VT supervision
2 N/O spare
2 N/C spare

Motor Wound Spring Mechanisms

All Feeder Breakers

Breaker Auxiliary Switches

As for solenoid breakers plus -

1 N/O for auto reclose counter circuit
1 N/C for spring release coil in place of solenoid contactor

Spring Auxiliary Switches

1 closed when springs charged for remote indication
1 closed when springs charged for auto reclose
1 closed when springs charged for spring release coil
1 open when springs charged for motor supplies
2 N/O spare
2 N/C spare

Incoming Transformer Units

Breaker Auxiliary Switches

As for solenoid breakers except -

1 N/C for spring release coil in place of solenoid contactor

Spring Auxiliary Switches

1 closed when springs charged for remote indication
1 open when springs charged for motor supplies
1 closed when springs charged for spring release coil
1 open when springs charged for motor supplies
2 N/O spare
2 N/C spare

Bus Section

Breaker Auxiliary Switches

As for solenoid mechanism except -

1 N/C for spring release coil in place of solenoid contactor

Spring Auxiliary Switches

1 closed when springs charged for remote indication
1 open when springs charged for motor supplies
1 closed when springs charged for spring release coil
1 open when springs charged for motor supplies
2 N/O spare
2 N/C spare

APPENDIX C

LIST OF WPD STANDARD DRAWINGS FOR 33kV VOLTAGE TRANSFORMER TYPES VT1 AND VT2

General

SM 61	-	Reinforced Concrete Support for Voltage Transformer
SM 97	-	Voltage Transformer Terminal Box
SM 121	-	Voltage Transformer Mounting Channel
SM 122	-	Voltage Transformer Support Angle
SMPC 129	-	Current Diagram of VT and Terminal/Boxes

Arrangement Type VT1

SMGA 11	-	33kV VT Support Arrangement (Busbar or Feeder Circuit)
SMGA 16	-	General Arrangement of VT Terminal Box (VT1)
SMGA 17	-	Diagram of Connections of VT Feeder Terminal Box (TB-VT1)
SM 123	-	Fuse and Link Label (VT1)
SMPC 127	-	Current Diagram of VT and Feeder Terminal Box (VT1)

Arrangement Type VT2

SMGA 1004	-	33kV VT Support Arrangement Grid Circuit)
SMGA 1006	-	General Arrangement for VT Terminal Box (VT2)
SMGA 1007	-	Diagram of Connections of VT Terminal Box (TB-VT2)
SM 1004	-	Fuse and Link Label (VT2)
SMPC 128	-	Current Diagram of VT and Grid Terminal Box (VT2)

Notes on Transducers, Interposing Relays, Switches etc. Required on Circuit Breakers for Telecontrol Purposes

WPD are operating a telecommand system (SWEDAT) for control and data collection purposes. Facilities for circuit breaker control and data collection will be required on switchgear.

The schedules listing switchgear may include requirements for interposing relays, status switches, transducers and push buttons. Each of these items detailed on a WPD Data sheet number. The Data Sheets are in separately numbered sequences for interposing relays, status switches, transducers and push buttons and are available on request.

All interposing relays, transducers, etc. shall be mounted in an accessible position with adequate spacing to accommodate secondary wiring.

General Information

1. **Transducers**

   To be provided by the manufacturer unless otherwise specified. Location in the cubicle must allow easy access for testing and removal.

2. **Interposing Relays (Standard)**

   To be provided by the Manufacturer. These items are manufactured by Clifford & Snell. Transient suppression diodes are fitted to the operating coil and therefore polarity of the coil circuit must be observed.

3. **Interposing Relay (Special)**

   To be provided by the Manufacturer. In certain cases, the standard C&S relays and special interposing relays are required. Details of these relays where required can be found on the appropriate Data sheets. Transient suppression diodes are required across the operating coils and therefore polarity of the coil circuit must be observed. Location in the cubicle must allow easy access for testing and removal.

4. **Interposing Relays (Bases)**

   To be provided by the Manufacturer. Front or rear terminal bases shall be provided. These items are manufactured by Clifford & Snell. Location in the cubicle must allow easy access for testing and removal of relays.

5. **Protection Trip Reed Relays**

To be provided by the Manufacturer.

6. **Push Buttons**

To be provided by the Manufacturer. Items used by WPD for converting existing plant are manufactured by Highland Electronics. However, manufacturers can offer alternative pushbuttons, labels and label holders to harmonise the control cubicle layout. Items to be suitable for use on 48V dc.

7. **Indicators (Lamp)**

To be provided by the Manufacturer. Lamp indicators with a clear lens are often included in the push buttons. Lamps should be 130V 20 mA Part No. 1L10/130/0.02/B. Data sheets are available from WPD. Items used by WPD for converting existing plant are manufactured by Highland Electronics. However, manufacturers can offer alternative lampholders, labels, label holders to harmonise the control cubicle layout.

8. **Status Switches**

To be provided by the manufacturer. The items used by WPD are manufactured by Craig & Derricott. However, manufacturers can offer alternative switches and labels to harmonise the control panel layout. Items to be suitable for use on 48V dc.

9. **Terminal Blocks**

To be provided by manufacturer. The terminal blocks for terminating the multipair cables from the plant to the telecommand outstation should be Klippon SAKR with hinged isolating link and two test sockets. Terminal blocks offering the same facilities by another manufacturer can be offered for approval. Care must be exercised by the manufacturer to ensure easy access to terminal blocks.

10. **Wiring**

All 48 volt status and control wiring on the telecontrol circuits shall be 1.5 sq. mm 7/0.53, 1.5 sq. mm 32/0.25, or 1.0 sq. mm 32/0.20 Cu single black PVC wire. The 10mA dc output circuits from the transducers require twisted pairs and this wiring can be fabricated from the 1.5 or 1.0 sq. mm. wire used for the 48 volt circuits. 48 volt control, status and transducer output wiring shall be loomed quite separate from other wiring in the cubicle and circuit breaker to reduce electrical interference from ac and other dc wiring.

All wires must be ferruled for identification purposes.

11. Multicore & Multipair Cable Terminations

Terminals must be provided for both normal plant requirements and telecontrol to allow easy access to the terminals for testing purposes. Sufficient gland plate area must be provided for terminating pilot and telecontrol cables. Note the WPD standard multipair cables are 5 pair 10 pair and 20 pair and more than one cable may be required to provide sufficient circuits. An earth terminal must be provided for terminating the drain wires in the multipair cables.

12. Multipair Cable Glands

To be provided by manufacturer. WPD to advise type of multipair cable for each cubicle to enable glands to be identified.

APPENDIX E

FINAL DRAWINGS - MEDIA OPTIONS FOR TRANSFERRING FILES

Date transfer by

CD Rom	-	Standard CD
3 ½ " floppy (1.44mb)	-	DOS copy, PKzip, etc
e-mail		

Data Types:

Drawings can be accepted in the following data types:

Microstation	-	Intergraph Multi-platform data type
DXF	-	Standard dxf (Please note release level)

SECTION 1A

WESTERN POWER DISTRIBUTION plc

36kV Circuit Breakers Schedule of Equipment for 33/11kV Substations Index

SECTION 1A

DRAWING SCHEDULE

33kV Circuit Breakers for 33/11kV Substations

Circuit Type	AC Circuit	DC Circuit	Cubicle Arrangement
33F1R	SMPC 100	SMPC 101	SMPC 66
33F1G	SMPC 102	SMPC 103	SMPC 67
33S2R } FRC-33S2R }	SMPC 108*	SMPC 109*	SMPC 72
33S2G } FRC-33S2G }	SMPC 110*	SMPC 111*	SMPC 73
* -	See also SPMC 123, 124	and 125	

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.	Description	No. Reqd per unit
1	Type 33F1R Feeder with Reyrolle distance and directional earth-fault protection equipped as follows:-	
1.1	1250 amp circuit breaker	1
1.2	Closing mechanism S or XEM (see ordering schedule)	1
1.3	DC shunt trip coil 110 volts DC spring releases coil 110 volts (if XEM)	1 1
1.4	Auxiliary switches (see separate schedule)	1 set
1.5	Local manual trip button and indication of circuit breaker position	1
1.6	Local circuit breaker control switch GEC type RC pistol grip	1
1.7	Local/remote changeover switch GEC type RS	1
1.8	Fuse, links, terminal blocks and secondary wiring	As required
1.9	Current Transformers ratio 800/400/1 Class 30VA 5P10 for distance protection	3
1.10	Current transformers ratio 800/400/1 Class 30VA 5P10 for directional earth fault protection and indication	3
1.11	Multicore/multipair terminations and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables	1

SECTION 1A

SCHEDULE OF EQUIPMENT

1

Item No.	Description	No. Reqd per unit
1.12	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	1.12.1 4" diameter Ammeter flush mounted GEC Elite 4E scaled 0-500A and 0-1000A	1
	1.12.2 Indication lamps Highland Electronics 04 series (open, close, healthy trip, springs charged)	4
	1.12.3 Trip supply healthy push button Highland Electronic 04 series (H2 scheme)	1
	1.12.4 Remote/supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	1.12.5 Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	1.12.6 Reyrolle type MHR4 distance relay 110/125V dc 1 amp flush mounted, ring terminations	1
	1.12.7 GEC MMLG test block, flush mounted, ring terminations	2
	1.12.8 Auto reclose maintenance lockout relay Reyrolle type AFD 110/125V dc flush mounted ring terminations with case reset mechanism	1
	1.12.9 Earth fault relay GEC type MCGG22 multi characteristic 110/125V dc supply	1
	1.12.10 Directional element GEC type MET111 1 amp flush mounting 110/125V dc supply, ring terminations	1
	1.12.11 GEC MMLG test block flush mounted, ring terminations	1
	1.12.12 Auto reclose auto/non-auto selector push button switch PB1 (Data Sheet 1). Push button illuminated PB1A. Interposing relay - A.R. - (Data Sheet 9).	1 1 1
	1.12.13 Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts available)	1
	1.12.14 Auto reclose in progress relay Clifford and Snell D2600/24 110V dc coil	1

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.	Description	No. Reqd per unit
	1.12.15 Circuit breaker close interposing relay - Clifford and Snell D2600 see WPD Data Sheet 1	1
	1.12.16 Circuit Breaker open interposing relay - Clifford and Snell D2600 see WPD Data Sheet 2	
	1.12.17 Protection trip reed relay - see WPD Data Sheet 26	
	1.12.18 Current transducers 1 amp see WPD Data Sheet 2 or 12	
	1.12.19 Fuses, Links GEC Red Spot and labels	As required
	1.12.20 Terminal blocks Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	1.12.21 Wiring, labels, gland plates etc	As required
	NOTE: The following item shall be provided if the circuit breaker utilises SF6:-	
	Alarm relay GEC type MVAA11, flush mounted 110/125V dc, ring terminations, self reset contacts, hand reset indicator for low gas pressure	
	Contacts: 1M for alarm 1B for interlock 1B for spare 3M for spare	

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.	Description	No. Reqd per unit
2	Type 33F1G Feeder with GEC distance and directional earth fault protection equipped as follows:-	
2.1	1250 amp circuit breaker	1
2.2	Closing mechanism S or XEM (see ordering schedule)	1
2.3	DC shunt trip coil 110 volts DC spring release coil 110 volts (if XEM)	1
2.4	Auxiliary switches (see separate schedule)	1 set
2.5	Local manual trip button and indication of circuit breaker position	1
2.6	Local circuit breaker control switch GEC type RC pistol grip	1
2.7	Local/remote changeover switch GEC type RS	1
2.8	Fuse, links, terminal blocks and secondary wiring	As required
2.9	Current Transformers ratio 800/400/1 Class 30VA 5P10 for distance protection	3
2.10	Current transformers ratio 800/400/1 Class 30VA 5P10 for directional earth fault protection and indication	3
2.11	Multicore/multipair terminations and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables	1

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.	Description	No. Reqd per unit
2.12	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	2.12.14" diameter Ammeter flush mounted GEC Elite 4E scaled 0-500A and 0-1000A	1
	2.12.2Indication lamps Highland Electronics 04 series (open, close, healthy trip springs charged)	4
	2.12.3Trip supply healthy push button Highland electronics 04 series (H2 scheme)	1
	2.12.4Remote/Supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	2.12.5Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	2.12.6Auto reclose relay GEC MVTR52 model 601 flush mounted ring terminations 110/125V dc with blocking diode and metrosil	1
	2.12.7GEC Quadramho type SHPM101 distance relay with mho phase fault and quadrilateral earth fault characteristic. 1 amp 110/125V dc flush mounted ring terminations	1
	2.12.8Earth fault relay GEC type MCGG22 multi characteristic 1 amp flush mounting ring terminations 110/125V dc supply	1
	2.12.9Directional element GEC type MET111 1 amp flush mounting ring terminations 110/125V dc supply	1
	2.12.10GEC MMLG test block flush mounted, ring terminations	1
	2.12.11Auto reclose auto/non-auto selector push button switch PB1 (Data Sheet 1) Push button illuminated PB1A Interposing relay A.R. (Data Sheet 9)	1 1 1
	2.12.12Auto reclose counter reset push button Highland Electronics 04 series	1
	2.12.13Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts available)	1

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.	Description	No. Reqd per unit
	2.12.14Distance protection switch onto fault auxiliary relay Clifford and Snell D2600/24110V dc coil	1
	2.12.15Circuit breaker close interposing relay - Clifford and Snell D2600 see WPD Data Sheet 1	1
	2.12.16 Circuit Breaker open interposing relay -Clifford and Snell D2600 see WPD Data Sheet 2	1
	2.12.17Protection trip reed relay - see WPD Data Sheet 26	1
	2.12.18Current transducers 1 amp see WPD Data Sheet 2 or 12	3
	2.12.19Fuses, Links GEC Red Spot and labels	As required
	2.12.20Terminal blocks Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	2.12.21Wiring, labels, gland plates etc	As required
	NOTE: 1.The following item shall be provided if the circuit breaker utilises SF6:-	
	Alarm relay GEC type MVAA11, flush mounted 110/215V dc ring terminations, self reset contacts, hand reset indicator for low gas pressure Contacts: 1M for alarm 1B for interlock 1B for spare 3M for spare	
	2.Resistor bridge for artificial star point to be provided for Quadramho relay when system is earthed via arc suppression coil	

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.	Description	No. Reqd per unit
	Type 33S2R	
3	Section breaker for one switch 33/11kV substation with Reyrolle distance protection and directional earth fault IDMT protection equipment as follows:-	
3.1	800 amp vacuum or SF6 circuit breaker with steel supporting structure	1
3.2	Current transformer ratio 800/400/1A Class 30VA 5P10 for distance and directional earth fault protection and indication	6
3.3	Local mechanism cabinet equipped with:-	
	3.3.1 Motor wound spring closing mechanism	1
	3.3.2 DC shunt trip coil 110V	1
	3.3.3 DC spring release coil 110V	1
	3.3.4 Local c.b. control handle GEC RC pistol grip or equivalent	1
	3.3.5 Local/remote change over switch GEC RS or equivalent	1
	3.3.6 Local manual trip button	1
	3.3.7 Circuit breaker and spring charge auxiliary switches	1 Set
	3.3.8 Fortress interlocks	1 set
	3.3.9 Internal heater with isolating switch	1
	3.3.10 Isolating fuses and links GEC Red Spot	1 set

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.	Description	No. Reqd per unit
3.4	Wall mounted control/relay cubicle 2000mm high 760mm side 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	3.4.1 4" diameter Ammeter flush mounted GEC Elite 4E scaled 0-500A and 0-1000A	1
	3.4.2 4" diameter moving coil voltmeter rectifier type with zener diode suppression flush mounted GEC Elite 4E suppressed zero scaled 20-40kV. (110V ac input for 33kV nominal). Class 1.5 Table 1 BS 89 (1977) with external adjustment	1
	3.4.3 Indication lamps Highland Electrics 04 series (open, close, healthy trip, springs charged)	4
	3.4.4 Health trip push button Highland Electronics 04 series (H2 scheme)	1
	3.4.5 Auto reclose maintenance lockout delay Reyrolle type AFD 110/125 dc, flush mounted ring terminations with case reset mechanism	1
	3.4.6 Auto reclose lockout relay GEC type MVAA13 110/125V dc, hand reset indicator, hand reset 3M3B contacts, flush mounted, ring terminations	1
	3.4.7 Remote/supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	3.4.8 Circuit breaker control switch - pistol grip Craig and Derricott	1
	3.4.9 Auto reclose auto/non auto selector switch - Craig and Derricott 16A minirotary double pole	1
	3.4.10 Indication supply switch OFF/AC/DC - Craig and Derricott	1
	3.4.11 Auto reclose in progress relay. Clifford and Snell D2600/24 110V dc coil	1
	3.4.12 Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (required if insufficient auxiliary switches are available on circuit breaker)	1
	3.4.13 Circuit breaker close interposing relay - Clifford and Snell D2600 series see WPD Data Sheet 1	1

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.		Description	No. Reqd per unit
	3.4.14	Circuit breaker open interposing relay - Clifford and Snell D2600 series see WPD Data Sheet 2	1
	3.4.15	240/110V transformer for indicating lamp supply	1
	3.4.16	Indication ac supply changeover relay Clifford and Snell D2600/24 110V ac coil	1
	3.4.17	Protection trip reed relay - Rochester Instruments - See WPD Data Sheet 26	1
	3.4.18	Voltage transducer 110V ac input see WPD Data Sheet 4 or 14	1 free issue
	3.4.19	Current transducers 1A ac input see WPD Data Sheet 2 or 12	3 free issue
	3.4.20	Terminal blocks Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	3.4.21	Fuses and links GEC red spot labels	As required
	3.4.22	Wiring, labels, gland plates etc.	As required
		NOTE**:** 1.VT supervision scheme based on one VT only at single switch substation 2.If system earthed via arc suppression coil, voltage supervision relay to be Midland and Automation type BCE0201. 3.The following item shall be provided if the circuit breaker utilises SF6:-	
		Alarm relay GEC MVAA11 110/125 Volt dc flush mounted, ring terminations self reset contacts, hand reset indicator for low gas pressure. Contacts: IM for alarm 1B for interlock 1B for spare 3M for spare	1

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.	Description	No. Reqd per unit
	Type FRC - 33S2R Feeder relay panel for 33/11kV one switch substation, with Reyrolle distance relay and GEC directional earth fault protection equipped as follows:-	
3.5	Wall mounted relay/control panel 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	3.5.1 Reyrolle type MHR4 impedence relay 110/125V dc 1 amp flush mounted, ring terminations	1
	3.5.2 GEC MMLG test block, flush mounted, ring terminations	2
	3.5.3 GEC MCGG22 earth fault relay 1 amp 50Hz 110/125V dc supply multi characteristic, flush mounted, ring terminations	1
	3.5.4 GEC METI11 directional element 1 amp 50Hz 110/125V dc flush mounted, ring terminations	1
	3.5.5 GEC MMLG test block flush mounted, ring terminations	1
	3.5.6 Tripping relay GEC MVAJ 26 self reset after 2 second delay, two stacks of self reset 7M3B contacts, hand reset indicator 110/125V dc flush mounted ring terminations	1
	3.5.7 Fuses and links GEC Red Spot Labels	As required
	3.5.8 Terminal Boards Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	3.5.9 Wiring, labels, glandplates, etc	As required
	NOTE**:** Items 3.5.3, 3.5.4 and 3.5.5 are not required on systems using arc suppression coil earthing	

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.	Description	No. Reqd per unit
	Type 33S2G	
4	Section breaker for one switch 33/11kV substation, with GEC distance and directional earth fault IDMT protection, equipped as follows:-	
4.1	800 amp vacuum or SF6 circuit breaker with steel supporting structure	1
4.2	Current transformers ratio 800/400/1 amp Class 30VA 5P10 for distance and directional earth fault protection and indication	6
4.3	Local mechanism cabinet equipped with:-	
	4.3.1 Motor wound spring closing mechanism	1
	4.3.2 DC shunt trip coil 110V	1
	4.3.3 DC spring release coil 110V	1
	4.3.4 Local c.b. control handle GEC RC pistol grip or equivalent	1
	4.3.5 Local/remote change over switch GEC RS or equivalent	1
	4.3.6 Local manual trip button	1
	4.3.7 Circuit breaker and spring charge auxiliary switches	1 set
	4.3.8 Fortress interlocks	1 set
	4.3.9 Internal heater with isolating switch	1
	4.3.10 Isolating fuses and links GEC Red Spot	1 set
4.4	Wall mounted relay/control cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	4.4.1 4" diameter Ammeter flush mounted GEC Elite 4E scaled 0-500A and 0-1000A	1
	4.4.2 4" diameter moving coil voltmeter rectifier type with zener diode suppression flush mounted GEC Elite E4 suppressed zero scaled 20-40kV. (110V AC input for 33kV nominal). Class 1.5 Table 1 BS 89 (1977) with external adjustment.	1

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.	Description	No. Reqd per unit
	4.4.3 Indication lamps Highland Electronics 04 series (open, close, healthy trip, springs charged)	4
	4.4.4 Healthy trip push button Highland Electronics 04 series (H2 scheme)	1
	4.4.5 Auto reclose counter reset push button. Highland Electronics 04 series	1
	4.4.6 Remote/supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	4.4.7 Circuit Breaker Control Switch - Pistol grip Craig and Derricott	1
	4.4.8 Auto reclose Auto/Non Auto selector switch - Craig and Derricott 16A Minirotary double pole	1
	4.4.9 Auto reclose lockout relay GEC type MVAA13 110/125V dc, hand reset indicator, hand reset 3M3B contacts, flush mounted, ring terminations	1
	4.4.10 Indication supply switch AC/OFF/DC - Craig and Derricott	1
	4.4.11 Auto reclose relay GEC MVTR52 Model 601 flush mounted ring terminations 110/125V dc	1
	4.4.12 Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (required if insufficient auxiliary switches are available on circuit breaker)	1
	4.4.13 Circuit breaker close interposing relay - Clifford and Snell D2600 Series see WPD Data Sheet 1	1
	4.4.14 Circuit breaker open interposing relay - Clifford and Snell D2600 Series See WPD Data Sheet 2	1
	4.4.15 240/110V transformer for indicating lamp supply	1
	4.4.16 Indication ac supply changeover relay Clifford and Snell D2600/24 110V AC coil	1
	4.4.17 Protection trip reed relay - Rochester Instruments - See WPD Data Sheet 26	1
	4.4.18 Voltage transducer 110V ac input see WPD Data Sheet 4 or 14	1 free issue

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.	Description	No. Reqd per unit
	4.4.19 Current transducers 1A ac input see WPD Data Sheet 2 or 12	3 free issue
	4.4.20 Terminal boards Klippon RSF1 and, for 50V supervisory wiring SAKR.	As required
	4.4.21 Fuses and links GEC Red Spot Labels	As required
	4.4.22 Wiring, labels, gland plates etc.	As required
	NOTE**:** 1.VT Supervision Scheme based on one VT only at single switch substation. 2.If system is earthed via arc suppression coil, voltage supervision relay to be Midland Automation Type BCE0201. 3.The following item shall be provided if the circuit breaker utilises SF6:-	
	Alarm relay GEC MVA11 110/125V dc, flush mounted, ring terminations, self reset contacts, hand reset indicator for low gas pressure.	1
	Contacts: 1M for alarm 1B for interlock 1B for spare 3M for spare	

SECTION 1A

SCHEDULE OF EQUIPMENT

Item No.	Description	No. Reqd per unit
	Type FRC - 33S2G Feeder relay cubicle for 33/11kV one switch substation, with GEC distance relay and directional earth fault protection equipped as follows:-	
4.5	Wall mounted relay/control panel 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	4.5.1 GEC Quadramho type SHPM101 distance relay with mho phase fault and quadrilateral earth fault characteristics. 1 amp 110/125 dc flush mounted ring terminations	1
	4.5.2 GEC MCGG22 earth fault relay 1 amp 50Hz 110/125V dc supply multi characteristic, flush mounted, ring terminations	1
	4.5.3 GEC METI11 directional element 1 amp 50Hz 110/125V dc flush mounted, ring terminations	1
	4.5.4 GEC MMLG test block flush mounted, ring terminations	1
	4.5.5 Tripping relay GEC MVAJ 26 self reset after 2 second delay, two stacks of self reset 7M3B contacts, hand reset indicator 110/125V dc flush mounted ring terminations	1
	4.5.6 Distance protection switch onto fault auxiliary relay Clifford and Snell D2600 110/125V dc coil	1
	4.5.7 Fuses and links GEC Red Spot Labels	As required
	4.5.8 Terminal Blocks Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	4.5.9 Wiring, labels, gland plates etc.	As required
	NOTE: 1.Resistor bridge for artificial star point to be provided for Quadramho relay when system is earthed via arc suppression coil. 2.Items 4.5.2, 4.5.3 and 4.5.4 are not required on systems using arc suppression coil earthing.	

SECTION 1B

WESTERN POWER DISTRIBUTION plc

36kV Circuit Breakers Schedule of Equipment for 132/33kV Substations Index

SECTION 1B

DRAWING SCHEDULE

36kV Circuit Breakers for 132/33kV Substations

Circuit Type	AC Circuit	DC Circuit	Cubicle Arrangement
33F3R	SMPC 117	SMPC 118	SMPC 70
33F3G	SMPC 119	SMPC 120	SMPC 71
33TF1	SMPC 112	SMPC 113	SMPC 60
33TF2	SMPC 112	SMPC 114	SMPC 61
33TF3 Form 1	SMPC 112 SMPC 603	SMPC 115 SMPC 604	)SMPC)64
33TF3 Form 2	SMPC 112 SMPC 603	SMPC 115 SMPC 604	SMPC 62 SMPC 52
33TFAR4	SMPC 112	SMPC 116	SMPC 63
33B1	SMPC 121	SMPC 122	SMPC 74
33B2	SMPC 121	SMPC 122	SMPC 74
33IT45	SMPC 132	SMPC 132	-
33IT60	SMPC 132	SMPC 132	-
33IT90	SMPC 132	SMPC 132	-
VT SUP 132/33	SMPC 126	SMPC 126	-

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
1	Type 33F3R Feeder with Reyrolle distance and overcurrent earth-fault protection equipped as follows:-	
1.1	1250 amp circuit breaker	1
1.2	Closing mechanism S or XEM (see ordering schedule)	1
1.3	DC shunt trip coil 110 volts DC spring releases coil 110 volts (if XEM)	1 1
1.4	Auxiliary switches (see separate schedule)	1 set
1.5	Local manual trip button and indication of circuit breaker position	1
1.6	Local circuit breaker control switch GEC type RC pistol grip	1
1.7	Local/remote changeover switch GEC type RS	1
1.8	Fuse, links, terminal blocks and secondary wiring	As required
1.9	-288Current Transformers ratio 800/400/1 Class 30VA 5P10 for distance protection	3
1.10	Current transformers ratio 800/400/1 Class 30VA 5P10 for overcurrent earth fault protection and indication	3
1.11	Multicore/multipair terminations and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
1.12	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	1.12.1 4" diameter Ammeter flush mounted GEC Elite 4E scaled 0-500A and 0-1000A	1
	1.12.2 Indication lamps Highland Electronics 04 series (open, close, healthy trip, springs charged)	4
	1.12.3 Trip supply healthy push button Highland Electronic 04 series (H2 scheme)	1
	1.12.4 Remote/supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	1.12.5 Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	1.12.6 Reyrolle type MHR4 distance relay 110/125V dc 1 amp flush mounted, ring terminations	1
	1.12.7 GEC MMLG test block, flush mounted, ring terminations	2
	1.13.8 Auto reclose maintenance lockout relay Reyrolle type AFD 110/125V dc flush mounted ring terminations with case reset mechanism	1
	1.12.9 GEC MCGG52 overcurrent and earth fault relay, multi characteristic, 1 amp 50HZ. 110/125V dc, flush mounted, ring terminations	1
	1.12.10 GEC MMLG test block flush mounted, ring terminations	1
	1.12.11 Auto reclose in push button - Highland Electronics 04 series see WPD Data Sheet	1
	1.12.12 Auto reclose out illuminated push button - Highland Electronics 04 series see WPD Data Sheet PB1A	1
	1.12.13 Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts available)	1
	1.12.14 Auto reclose in progress relay Clifford and Snell D2600/24 110V dc coil	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	1.12.15 Circuit breaker close interposing relay - Clifford and Snell D2600 see WPD Data Sheet 1	1
	1.12.16 Circuit Breaker open interposing relay -Clifford and Snell D2600 see WPD Data Sheet 2	1
	1.12.17 Auto reclose in/out interposing relay - Clifford and Snell D2600 see WPD Data Sheet 9	1
	1.12.18 Protection trip reed relay - see WPD Data Sheet 26	1
	1.12.19 Current transducers 1 amp see WPD Data Sheet 1 or 11	1
	1.12.20 Phase angle transducer 110V ac/1, see WPD data sheets 5 and 15	*1
	1.12.21 Fuses, Links GEC Red Spot and labels	As required
	1.12.22 Terminal blocks Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	1.12.23 Wiring, labels, gland plates etc.	As required
	NOTE: The following item shall be provided if the circuit breaker utilises SF6:-	
	Alarm relay GEC type MVAA11, 110/125V dc flush mounted. ring terminations self reset contacts, hand reset indicator for low gas pressure	
	Contacts: 1M for alarm 1B for interlock 1B for spare 3M for spare	

*only required when parallel running of 132/33kV substations is employed

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
2	Type 33F3G Feeder with GEC distance and overcurrent earth fault protection equipped as follows:-	
2.1	1250 amp circuit breaker	1
2.2	Closing mechanism S or XEM (see ordering schedule)	1
2.3	DC shunt trip coil 110 volts DC spring release coil 110 volts (if XEM)	1 1
2.4	Auxiliary switches (see separate schedule)	1 set
2.5	Local manual trip button and indication of circuit breaker position	1
2.6	Local circuit breaker control switch GEC type RC pistol grip	1
2.7	Local/remote changeover switch GEC type RS	1
2.8	Fuse, links, terminal blocks and secondary wiring	As required
2.9	Current Transformers ratio 800/400/1 Class 30VA 5P10 for distance protection	3
2.10	Current transformers ratio 800/400/1 Class 30VA 5P10 for overcurrent and earth fault protection and indication	3
2.11	Multicore/multipair termination and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
2.12	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	2.12.1 4" diameter Ammeter flush mounted GEC Elite 4E scaled 0-500A and 0-1000A	1
	2.12.2 Indication lamps Highland Electronics 04 series (open, close, healthy trip, springs charged)	4
	2.12.3 Trip supply healthy push button Highland Electronics 04 series (H2 scheme)	1
	2.12.4 Remote/Supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	2.12.5 Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	2.12.6 Auto reclose relay GEC MVTR52 model 601 flush mounted ring terminations 110/125V dc with blocking diode and metrosil	1
	2.12.7 GEC Quadramho type SHPM101 distance relay with mho phase fault and quadrilateral earth fault characteristic. 1 amp 110/125V dc flush mounted ring terminations	1
	2.12.8 GEC MCGG52 overcurrent and earth fault relay multi characteristic, 1 amp 50HZ. 110/125V dc, flush mounted, ring terminations	1
	2.12.9 GEC MMLG test block flush mounted, ring terminations	1
	2.12.10 Auto reclose in push button - Highland Electronics 04 series see WPD Data Sheet PB1	1
	2.12.11 Auto reclose out illuminated push button - Highland Electronics 04 series see WPD Data Sheet PB1A	1
	2.12.12 Auto reclose counter reset push button Highland Electronics 04 series	1
	2.12.13 Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts available)	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	2.12.14 Distance protection switch onto fault auxiliary relay Clifford and Snell D2600/2 110V dc coil	1
	2.12.15 Circuit breaker close interposing relay - Clifford and Snell D2600 see WPD Data Sheet 1	1
	2.12.16 Circuit Breaker open interposing relay - Clifford and Snell D2600 see WPD Data Sheet 2	1
	2.12.17 Auto reclose in/out interposing relay - Clifford and Snell D2600 see WPD Data Sheet 9	1
	2.12.18 Protection trip reed relay - see WPD Data Sheet 26	1
	2.12.19 Current transducers 1 amp see WPD Data Sheet 1 or 11	3
	2.12.20 Phase angle transducer 110V ac/1 amp, see WPD data sheets 5 and 15	*1
	2.12.21 Fuses, Links, GEC Red Spot and labels	As required
	2.12.22 Terminal blocks Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	2.12.23 Wiring, labels, gland plates etc	As required
	NOTE: 1. The following item shall be provided if the circuit breaker utilises SF6:- Alarm relay GEC type MVAA 11, flush mounted 110/125V dc, ring contacts, hand reset indicator for low gas pressure Contacts: 1M for alarm 1B for interlock 1B for spare 3M for spare 2. Resistor bridge for artificial star point to be provided for Quadramho relay when system is earthed via arc suppression coil	

*only required when parallel running of 132/33kV substations is employed

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
3.	Type 33TF1 Transformer feeder without pilot intertripping quipped as follows:-	
3.1	1250 amp circuit breaker	1
3.2	Closing mechanism S or XEM (see ordering schedule)	1
3.3	DC shunt trip coil 110 volts DC spring release coil 110 volts (if XEM)	1 1
3.4	Auxiliary switches (see separate schedule)	1 set
3.5	Local manual trip button and indication of circuit breaker position	1
3.6	Local circuit breaker control switch GEC type RC pistol grip	1
3.7	Local/remote changeover switch GEC type RS	1
3.8	Fuse, links, terminal blocks and secondary wiring	1
3.9	Current Transformers ratio 800/400/1 or 300/150/1Class 30VA 5P10 for overcurrent protection and indication	3
3.10	Current transformers ratio 800/1 or Class 30VA 5P10 for balanced earth fault protection	3
3.11	Multicore/multipair terminations and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
3.12	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	3.12.1 4" diameter Ammeter flush mounted GEC Elite 4E scaled 0-500 and 0-1000A, or 0-200 and 0-400A	1
	3.12.2 Indication lamps Highland Electronics 04 series (open, close, healthy trip, springs charged)	4
	3.12.3 Trip supply healthy push button Highland electronics 04 series (H2 scheme)	1
	3.12.4 Remote/Supervisory change over switch Craig and Derricott see WPD Data Sheet CS4 3.15.5 Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	3.12.6 Balanced earth fault relay single pole 1A GEC type MCAG14 10-40% with stabilising resistor flush mounting ring terminations 110/125V dc supply	1
	3.12.7 Test block GEC type MMLG flush mounting ring terminations	1
	3.12.8 Overcurrent relay GEC type MCGG62 1A multi-characteristic 110/125V dc supply flush mounting, ring terminations	1
	3.12.9 Test block GEC type MMLG flush mounting ring terminations	1
	3.12.10 Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts available)	1
	3.12.11 Circuit breaker close interposing relay Clifford and Snell D2600 see WPD Data Sheet 1	1
	3.12.12 Circuit breaker open interposing relay, Clifford and Snell D2600 see WPD Data Sheet 2	1
	3.13.13 Protection trip reed relay see WPD Data Sheet 26	1
	3.12.14 Current transducer 1A - see WPD Data Sheets 1 or 11	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	3.12.15Fuses, Links GEC Red Spot and Labels	As required
	3.12.16Terminal blocks Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	3.12.17Wiring, labels, gland plates etc	As required
	NOTE:The following item shall be provided if the current breaker utilises SF6:-	
	Alarm relay GEC Type MVAA 11, self reset contacts, hand reset indicator. Flush mounted, ring terminations for low gas pressure	1
	Contacts: 1M for alarm	
	1B for interlock	
	1B for spare	
	3M for spare	

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
4.	Type 33TF2 Transformer feeder with pilot intertripping equipped as follows:-	
4.1	1250 amp circuit breaker	1
4.2	Closing mechanism S or XEM (see ordering schedule)	1
4.3	DC shunt trip coil 110 volts DC spring release coil 110 volts (if XEM)	1 1
4.4	Auxiliary switches (see separate schedule)	1 set
4.5	Local manual trip button and indication of circuit breaker position	1
4.6	Local circuit breaker control switch GEC type RC pistol grip	1
4.7	Local/remote changeover switch GEC type RS	1
4.8	Fuse, links, terminal blocks and secondary wiring	1
4.9	Current transformers ratio 800/400/1 or 300/150/1 Class 30VA 5P10 for overcurrent protection and indication	3
4.10	Current transformers ratio 800/1 or Class 30VA 5P10 for balanced earth fault protection	3
4.11	Multicore/multipair terminations and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
4.12	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	4.12.1 4" diameter Ammeter flush mounted GEC Elite 4E scaled 0-500 and 0-1000A, or 0-200 and 0-400A	1
	4.12.2 Indication lamps Highland Electronics 04 series (open, close, healthy trip, springs charged)	4
	4.12.3 Trip supply healthy push button Highland Electronics 04 series (H2 scheme)	1
	4.12.4 Remote/Supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	4.12.5 Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	4.12.6 Balanced earth fault relay single pole 1A GEC type MCAG14 10-40% with stabilising resistor flush mounting ring terminations 110/125V dc supply	1
	4.12.7 Test block GEC type MMLG flush mounting ring terminations	1
	4.12.8 Overcurrent relay GEC type MCGG62 1A multi-characteristic 110/125V dc supply flush mounting, ring terminations	1
	4.12.9 Test block GEC type MMLG flush mounting ring terminations	1
	4.12.10 Tripping relay GEC type MVAJ26, double contact stack, time delay self reset 7M, 3B contacts, hand reset indicator, 110/125V dc, flush mounting, ring terminations	1
	4.12.11 Surge proof intertrip receive relay GEC type DBS4 AF2501B, flush mounted draw out type with fixed and adjustable resistors type BRB ref: 47 and 148 and with isolating transformer. Hand reset indicator, 110/125V dc supply	1
	4.12.12 Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts are available)	1
	4.12.13 Circuit breaker close interposing relay Clifford and Snell D2600 see WPD Data	1
	4.12.14 Circuit breaker open interposing relay, Clifford and Snell D2600 see WPD Data	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	4.12.15 Protection trip reed relay - see WPD Data Sheet 26	1
	4.12.16 Current transducer 1A - see WPD Data Sheets 1 or 11	1
	4.12.17 Fuses, Links GEC Red Spot and labels	As required
	4.12.18 Terminal boards Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	4.12.19 Wiring, labels, gland plates etc	As required
	4.12.20 Caution label This label is mounted in the control/relay cubicle and shall be white with red letters worded as follows:- <u>CAUTION</u> SERIES INTERTRIPPING FITTED ON THIS UNIT ISOLATION LINKS ARE ON TERMINAL BLOCKS SITUATED IN PILOT BOX. OPENING THESE LINKS RENDERS INOPERATIVE <u>ALL</u> INTERTRIPPING ON THIS FEEDER NOTE:1. Pilot box to be provided and installed by Western Power Distribution 2. The following item shall be provided if the current breaker utilises SF6:- Alarm relay GEC type MVAA 11, 110/125V dc self reset contacts, hand reset indicator flush mounted, ring terminations for low gas pressure Contacts: 1M for alarm 1B for interlock 1B for spare 3M for spare	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
5	Type 33TF3 Form 1 Transformer feeder with local intertripping (33 and 11kV protection on combined cubicle equipped as follows:-	
5.1	1250 amp circuit breaker	1
5.2	Closing mechanism S or XEM (see ordering schedule)	1
5.3	DC shunt trip coil 110 volts DC spring release coil 110 volts (if XEM)	1 1
5.4	Auxiliary switches (see separate schedule)	1 set
5.5	Local manual trip button and indication of circuit breaker position	1
5.6	Local circuit breaker control switch GEC type RC pistol grip	1
5.7	Local/remote changeover switch GEC type RS	1
5.8	Fuse, links, terminal blocks and secondary wiring	1
5.9	Current transformers ratio 800/400/1 or 300/150/1 Class 30VA 5P10 for overcurrent protection and indication	3
5.10	Current transformers ratio 800/1 or Class 30VA 5P10 for balanced earth fault protection	3
5.11	Multicore/multipair terminations and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
5.12	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	<u>33kV Protection and Control</u>	
	5.12.1Indication lamps Highland Electronics 04 series (open, close, healthy trip, springs charged)	4
	5.12.2Trip supply healthy push button Highland Electronics 04 series (H2 scheme)	1
	5.12.3Remote/Supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	5.12.4Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	5.12.5Balanced earth fault relay single pole 1A GEC type MCAG14 10-40% with stabilising resistor flush mounting ring terminations 110/125V dc supply	1
	5.12.6Test block GEC type MMLG flush mounting ring terminations	1
	5.12.7Overcurrent relay GEC type MCGG62 1A multi-characteristic 110/125V dc supply flush mounting, ring terminations	1
	5.12.8Test block GEC type MMLG flush mounting ring terminations	1
	5.12.9Tripping relay GEC type MVAJ26, double contact stack, time delay self reset 7M, 3B contacts, hand reset indicator, 110/125V dc, flush mounting, ring terminations	1
	5.12.10Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts are available)	1
	5.12.11Circuit breaker close interposing relay Clifford and Snell D2600 see WPD Data Sheet 1	1
	5.12.12 Circuit breaker open interposing relay, Clifford and Snell D2600 see WPD Data Sheet 2	1
	5.12.13Protection trip reed relay - see WPD Data Sheet 26	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	NOTE:The following item shall be provided if the current breaker utilises SF6:-	
	Alarm relay GEC Type MVAA 11, self reset contacts, hand reset indicator. Flush mounted, ring terminations for low gas pressure	1
	Contacts: 1M for alarm 1B for interlock 1B for spare 3M for spare	
	11kV Protection	
	5.12.14Standby and Back up earth fault relays GEC MCGG22, 5 amp, 50Hz. 110/125v dc, flush mounted, ring terminations	2
	5.12.15GEC, MMLG test block, ring terminations	2
	5.12.16Restricted earth fault relay GEC, MFAC14, single element, 25v-175v, 50Hz, standard metrosil, flush mounted, ring terminations	1
	5.12.17GEC, MMLG, test block, ring terminations	1
	5.12.18Three indicator/trip relays for tapchanger buchholz trip, transformer buchholz trip, winding temperature trip	
	Consisting of:-	
	GEC, MCAA 21, 2 elements, each element with hand reset indicators, self reset contacts for main buchholz trip and winding temp trip	1
	Contacts:4M for spare	
	GEC, MCAA11, 1 element, hand reset, indicator self reset contacts for tapchange buchholz trip (if required) Contacts: 4M for spare	1
	5.12.19Two indicator/alarm relays for buchholz gas alarm, winding temperature alarm,	

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	Consisting of:-	
	GEC, MVAA21, two element, hand reset indicators on BOTH elements self reset contacts. 110/125v dc flush mounted, ring terminations	1
	Contacts:-1M for alarm 3M for spare	
5.12.20	Indicator/alarm relay for SF6 gas pressure low, transformer pressure relief device	1
	GEC MVAA21, two elements, hand reset indicators on both elements, self reset contacts	1
	Contacts:-1M for alarm) 1B for interlock) SF6 1B for spare) Relay 1M for spare) 1M for alarm) Pressure 3M for spare) Relief Relay	
	110/125v dc flush mounted ring terminations	
5.12.21	Fuses, links GEC Red Spot and labels	As required
5.12.22	Terminal blocks Klippon RSF1 and for 50V supervisory wiring SAKR	As required
5.12.23	Wiring, labels, gland plates etc	As required
	NOTE:Item 5.13.20 only required if circuit breaker has SF6 or transformer is fitted with pressure relief device	

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
6	Type 33TF3 Form 2 Transformer Feeder with local intertripping (33kV and 11kV protection on separate cubicles equipped as follows:	
6.1	1250 amp circuit breaker	1
6.2	Closing mechanism S or XEM (see ordering schedule)	1
6.3	DC shunt trip coil 110 volts DC spring releases coil 110 volts (if XEM)	11
6.4	Auxiliary switches (see separate schedule)	1 set
6.5	Local manual trip button and indication of circuit breaker position	1
6.6	Local circuit breaker control switch GEC type RC pistol grip	1
6.7	Local/remote changeover switch GEC type RS	1
6.8	Fuse, links, terminal blocks and secondary wiring	1
6.9	Current Transformers ratio 800/400/1 or 300/150/1Class 30VA 5P10 for overcurrent protection and indication	3
6.10	Current transformers ratio 800/1 30VA 5P10 for balanced earth fault protection	3
6.11	Multicore/multipair terminations and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
6.12	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	6.12.1Indication lamps Highland Electronics 04 series (open, close, healthy trip, springs charged)	4
	6.12.2Trip supply healthy push button Highland Electronic 04 series (H2 scheme)	1
	6.12.3Remote/supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	6.12.4Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	6.12.5Balanced earth fault relay single pole 1A GEC type MCAG14 10-40% with stabilising resistor flush mounting ring terminations 110/125V dc supply	1
	6.12.6Test block GEC type MMLG flush mounting ring terminations	1
	6.12.7Overcurrent relay GEC type MCGG62 1A multi-characteristic 110/125V dc supply flush mounting, ring terminations	1
	6.12.8Test block GEC type MMLG flush mounting ring terminations	1
	6.12.9Tripping relay GEC type MVAJ26, double contact stack, time relay self reset 7M3B contacts, hand reset indicator, 110/125V dc. flush mounting, ring terminations	1
	6.12.10Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts are available)	1
	6.12.11Circuit breaker close interposing relay - Clifford and Snell D2600 see WPD Data Sheet 1	1
	6.12.12Circuit Breaker open interposing relay - Clifford and Snell D2600 see WPD Data Sheet 2	1
	6.12.13Protection trip reed relay - see WPD Data Sheet 26	1
	6.12.14Fuses, Links GEC Red Spot and labels	As required

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	6.12.15Terminal blocks Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	6.12.16Wiring, labels, gland plates etc.	As required
	NOTE: 1. The following item shall be provided if the current breaker utilises SF6:-	
	Alarm relay GEC type MVAA 11, 110/125V dc self reset contacts, hand reset indicator flush mounted, ring terminations for low gas pressure	1
	Contacts:1M for alarm 1B for interlock 1B for spare 3M for spare	
	2.Details of 11kV transformer relay cubicles are given in Section 2B, following, Equipment types IT3B Forms 2A and 2B	

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
7	Type 33TFAR4 Transformer Feeder with auto-reclose equipped as follows:-	
7.1	1250 amp circuit breaker	1
7.2	Closing mechanism S or XEM (see ordering schedule)	1
7.3	DC shunt trip coil 110 volts DC spring release coil 110 volts (if XEM)	1 1
7.4	Auxiliary switches (see separate schedule)	1 set
7.5	Local manual trip button and indication of circuit breaker position	1
7.6	Local circuit breaker control switch GEC type RC pistol grip	1
7.7	Local/remote changeover switch GEC type RS	1
7.8	Fuse, links, terminal blocks and secondary wiring	1
7.9	Current Transformers ratio 800/400/1 or 300/150/1Class 30VA 5P10 for overcurrent protection and indication	3
7.10	Current transformers ratio 800/1 30VA 5P10 for balanced earth fault protection	3
7.11	Multicore/multipair terminations and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
7.12	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	1
	7.12.1 4" diameter Ammeter flush mounted GEC Elite 4E scaled 0-500A and 0-1000A, or 0-200 and 0-400A	1
	7.12.2 Indication lamps Highland Electronics 04 series (open, close, healthy trip, springs charged)	4
	7.12.3 Trip supply healthy push button Highland Electronics 04 series (H2 scheme)	1
	7.12.4 Remote/Supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	7.12.5 Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	7.12.6 Balanced earth fault relay single pole 1A GEC type MCAG14 10-40% with stabilising resistor flush mounting ring terminations 110/125V dc supply	1
	7.12.7 Test block GEC type MMLG flush mounting ring terminations	1
	7.12.8 Overcurrent relay GEC type MCGG62 1A multi characteristic 110/125V dc supply flush mounting, ring terminations	1
	7.12.9 Test block GEC type MMLG flush mounting ring terminations	1
	7.12.10 Auto reclose relay GEC MVTR52 Model 601 flush mounted ring terminations 110/125V dc with blocking diode and metrosil	1
	7.12.11 Auto reclose in push button Highland Electronics 04 series see WPD Data Sheet PB1A	1
	7.12.12 Auto reclose out illuminated push button - Highland Electronics 04 series see WPD Data sheet PB1A	1
	7.12.13 Auto reclose counter reset push button Highland Electronics 04 series	1
	7.12.14 Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts available)	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	7.12.15 Circuit breaker close interposing relay - Clifford and Snell D2600 see WPD Data Sheet 1	1
	7.12.16 Circuit Breaker open interposing relay - Clifford and Snell D2600 see WPD Data Sheet 2	1
	7.12.17 Auto reclose in/out interposing relay - Clifford and Snell D2600 see WPD Data Sheet 9	1
	7.12.18 Protection trip reed relay - see WPD Data Sheet 26	1
	7.12.19 Current transducers 1 amp see WPD Data Sheet 1 or 11	1
	7.12.20 Fuses, Links GEC Red Spot and labels	As required
	7.12.21 Terminal blocks Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	7.12.22 Wiring, labels, gland plates etc.	As required
	NOTE: The following item shall be provided if the circuit breaker utilises SF6:-	
	Alarm relay GEC type MVAA 11, self reset contacts, hand reset indicator. Flush mounted, ring terminations for low gas pressure Contacts:1M for alarm 1B for interlock 1B for spare 3M for spare	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
8	Type 33B1 Bus-section unit equipped as follows:-	
8.1	1250 amp circuit breaker	1
8.2	Closing mechanism S or XEM (see ordering schedule)	1
8.3	DC shunt trip coil 110 volts DC spring release coil 110 volts (if XEM)	1 1
8.4	Auxiliary switches (see separate schedule)	1 set
8.5	Local manual trip button and indication of circuit breaker position	1
8.6	Local circuit breaker control switch GEC type RC pistol grip	1
8.7	Local/remote changeover switch GEC type RS	1
8.8	Fuse, links, terminal blocks and secondary wiring	As required
8.9	Current transformers in yellow phase ratio 1200/800/1 15VA Class 0.5 for indication	1
8.10	Current transformers ratio 800/1 Class X for busbar protection, with 1250A primary rating	2 sets of 3
8.11	Multicore/multipair cable box for terminating PVC insulated SWA and sheathed multicore/multipair cables	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
8.12	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	
	8.12.1 4" diameter Ammeter flush mounted GEC Elite 4E scales 0-1000 and 0-1500A	1
	8.12.2 Indication lamps Highland Electronics 04 series (open, close, healthy trip, springs charged)	4
	8.12.3 Trip supply healthy push button Highland Electronics 04 series (H2 scheme)	1
	8.12.4 Remote/Supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	8.12.5 Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	8.12.6 Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts available)	1
	8.12.7 Circuit breaker close interposing relay Clifford and Snell D2600 see WPD Data Sheet 1	1
	8.12.8 Circuit Breaker open interposing relay - Clifford and Snell D2600 see WPD Data Sheet 2	1
	8.12.9 Protection trip reed relay - see WPD Data Sheet 26	1
	8.12.10 Current transducers 1 amp see WPD Data Sheet 1 or 11	1
	8.12.11 240/110V transformers for indicating lamp supply	1
	8.12.12 Indication supply changeover relay Clifford and Snell D2600/24 110V ac	1
	8.12.13 Indication AC/OFF/DC control switch Craig and Derricott	1
	8.12.14 Fuses, Links GEC Red Spot and labels	As required
	8.12.15 Terminal blocks Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	8.12.16 Wiring, labels, gland plates etc	As required

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	NOTE: 1.The following item shall be provided if the circuit breaker utilises SF6:-	
	Alarm relay GEC type MVAA 11, 110/125V dc self reset contacts, hand reset indicator, flush mounting, ring terminations for low gas pressure Contacts: 1M for alarm 1B for interlock 1B for spare 3M for spare	1
	2.When unit is second bus section in switchboard, items 8.12.11, 8.12.12, 8.12.13 are not required	

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
9.	Type 33B2 Bus-section unit equipped as follows:-	
9.1	2000 amp circuit breaker	1
9.2	Closing mechanism S or XEM (see ordering schedule)	1
9.3	DC shunt trip coil 110 volts DC spring release coil 110 volts (if XEM)	1 1
9.4	Auxiliary switches (see separate schedule)	1 set
9.5	Local manual trip button and indication of circuit breaker position	1
9.6	Local circuit breaker control switch GEC type RC pistol grip	1
9.7	Local/remote changeover switch GEC type RS	1
9.8	Fuse, links, terminal blocks and secondary wiring	As required
9.9	Current transformers in yellow phase ratio 2000/800/1 15VA Class 0.5 for indication	1
9.10	Current transformers ratio 800/1 Class X for busbar protection, with 2000A primary rating	2 sets of 3
9.11	Multicore/multipair terminations and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
9.12	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	
	9.12.14" diameter Ammeter flush mounted GEC Elite 4E scaled 0-1000 and 0-1500A	1
	9.12.2Indication lamps Highland Electronics 04 series (open, close, healthy trip, springs charged)	1
	9.12.3Trip supply healthy push button Highland Electronics 04 series (H2 scheme)	1
	9.12.4Remote/Supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	9.12.5Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	9.12.6Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts available)	1
	9.12.7Circuit breaker close interposing relay Clifford and Snell D2600 see WPD Data Sheet 1	1
	9.12.8Circuit Breaker open interposing relay - Clifford and Snell D2600 see WPD Data Sheet 2	1
	9.12.9Protection trip reed relay - see WPD Data Sheet 26	1
	9.12.10Current transducers 1 amp see WPD Data Sheet 1 or 11	1
	9.12.11240/110V transformers for indicating lamp supply	1
	9.12.12Indication supply changeover relay Clifford and Snell D2600/24 110V ac	1
	9.12.13Indication AC/OFF/DC control switch Craig and Derricott	1
	9.12.14Fuses, Links GEC Red Spot and labels	As required
	9.12.15Terminal blocks Klippon RSF1 and, for 50V supervisory wiring SAKR	As required
	9.12.16Wiring, labels, gland plates etc	As required

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	NOTE: 1.The following item shall be provided if the circuit breaker utilises SF6:-	
	Alarm relay GEC type MVAA 11 110/125V dc self reset contacts, hand reset indicator, flush mounting, ring terminations for low gas pressure	1
	Contacts:1M for alarm 1B for interlock 1B for spare 3M for spare	
	2.When unit is second bus section in switchboard, items 9.12.11, 9.12.12, 9.12.13 are not required	

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
10.	Type 33IT45 Incoming transformer unit for 45MVA transformer equipped as follows:-	
10.1	1250 amp circuit breaker	1
10.2	Closing mechanism S or XEM (see ordering schedule)	1
10.3	DC shunt trip coil 110 volts DC spring release coil 110 volts (if XEM)	1 1
10.4	Auxiliary switches (see separate schedule)	1 set
10.5	Local manual trip button and indication of circuit breaker position	1
10.6	Local circuit breaker control switch GEC type RC pistol grip	1
10.7	Local/remote changeover switch GEC type RS	1
10.8	Fuse, links, terminal blocks and secondary wiring	As required
10.9	Current transformers class X for biased differential and restricted earth fault protection ratio	3
10.10	Current transformers class 30VA 5P10 for overcurrent protection and instruments ratio	3
10.11	Current transformers for 15VA class 0.5 for metering ratio	2
10.12	Current transformer 15VA class 0.5 for automatic voltage control ratio	1
10.13	Current transformers ratio 800/1 Class X for busbar protection (Main)	3
10.14	Current transformers ratio ..... Class X for busbar protection (Check). *Subject to agreement - may not be needed for low impedence busbar protection schemes.	3*

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
10.15	Multicore/multipair terminations and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables NOTE:Continuous thermal rating of current transformers to match current rating of breaker	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
10.16	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	
	10.16.1 4" diameter ammeter, flush mounted, GEC Elite 4E Scale:-	1
	10.16.2 4" diameter MWatt/MVar meter, flush mounted, GEC Elite 4E Scale:- 20-0-80/20-0-80	1
	10.16.3 MWatt/MVar component box	1
	10.16.4 Changeover switch for MWatt/MVar meter Craig Derricott	1
	10.16.5 Indication lamps Highland Electronics 704 series (open, close, healthy trip, springs charged)	4
	10.16.6 Remote/Supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	10.16.7 Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	10.16.6 Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts are available)	1
	10.16.9 Circuit breaker close interposing relay Clifford and Snell D2600 see WPD Data Sheet 1	1
	10.16.10 Circuit breaker open interposing relay, Clifford and Snell D2600 see WPD Data Sheet 2	1
	10.16.11 Current transducer 1 amp (see WPD Data Sheets 1 or 11)	3

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	10.16.12Phase angle transducer 1 amp, 110V ac input (see WPD Data Sheet 5 or 15)	1
	10.16.13Voltage transducer 110V ac input (see WPD Data Sheet 4 or 14)	3
	10.16.14Fuses, links, GEC Red Spot and labels	As required
	10.16.15Terminal blocks, Klippon RSF1 and, for 50V supervisory wiring, SAKR	As required
	NOTE:The following item to be provided if the current breaker utilises SF6 or if transformer has pressure relief alarm	
	Alarm relay GEC Type MVAA 21, 110/125V dc, two elements, self reset contacts, hand reset indicators on BOTH elements flush mounted, ring terminations for low gas pressure	1
	Contacts:1M for alarm) 1B for interlock) SF6 relay 1B for spare) 3M for spare)	
	1M for alarm) Pressure relief 3M for spare) relay	

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
11	Type 33IT60 Incoming transformer unit for 60MVA transformer equipped as follows:-	
11.1	2000 amp circuit breaker	1
11.2	Closing mechanism S or XEM (see ordering schedule)	1
11.3	DC shunt trip coil 110 volts DC spring release coil 110 volts (if XEM)	1
11.4	Auxiliary switches (see separate schedule)	1 set
11.5	Local manual trip button and indication of circuit breaker position	1
11.6	Local circuit breaker control switch GEC type RC pistol grip	1
11.7	Local/remote changeover switch GEC type RS	1
11.8	Fuse, links, terminal blocks and secondary wiring	As required
11.9	Current transformers class X for biased differential and restricted earth fault protection ratio	3
11.10	Current transformers class 30VA 5P10 for overcurrent protection and instruments ratio	3
11.11	Current transformers for 15VA class 0.5 for metering ratio	2
11.12	Current transformer 15VA class 0.5 for automatic voltage control ratio	1
11.13	Current transformers ratio 800/1 Class X for busbar protection (Main)	3
11.14	Current transformers ratio ..... Class X for busbar protection (Check). *Subject to agreement - may not be required for low impedence busbar protection schemes.	3

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
11.15	Multicore/multipair terminations and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables NOTE:Continuous thermal rating of current transformers to match rating of current breaker	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
11.16	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	
	11.16.1 4" diameter ammeter, flush mounted, GEC Elite 4E Scale:-	1
	11.16.2 4" diameter MWatt/MVar meter, flush mounted, GEC Elite 4E Scale:- 20-0-100/20-0-100	1
	11.16.3 MWatt/MVar component box	1
	11.16.4 Changeover switch for MWatt/MVar meter Craig Derricott	1
	11.16.5 Indication lamps Highland Electronics 704 series (open, close, springs charged)	3
	11.16.6 Remote/Supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	11.16.7 Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	11.16.8 Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts are available)	1
	11.16.9 Circuit breaker close interposing relay Clifford and Snell D2600 see WPD Data Sheet 1	1
	11.16.10 Circuit breaker open interposing relay, Clifford and Snell D2600 see WPD Data Sheet 2	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	11.16.11Current transducer 1 amp, (see WPD Data Sheets 1 or 11)	3
	11.16.12Phase angle transducer 1 amp, 110V ac input (see WPD Data Sheet 5 or 15)	1
	11.16.13Voltage transducer 110V ac input (see WPD Data Sheet 4 or 14)	3
	11.16.14Fuses, links, GEC Red Spot and labels	As required
	11.16.15Terminal blocks, Klippon RSF1 and, for 50V supervisory wiring, SAKR	As required
	NOTE:The following item to be provided if the current breaker utilises SF6 or if transformer has pressure relief alarm	
	Alarm relay GEC Type MVAA 21, 110/125V dc, two elements, self reset contacts, hand reset indicators on BOTH elements flush mounted, ring terminations for low gas pressure	1
	Contacts:1M for alarm) 1B for interlock) SF6 relay 1B for spare) 3M for spare)	
	1M for alarm) Pressure relief 3M for spare) relay	

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
12	Type 33IT90 Incoming transformer unit for 90MVA transformer equipped as follows:-	
12.1	2500/2000 amp circuit breaker *see note 2 following	1
12.2	Closing mechanism S or XEM (see ordering schedule)	1
12.3	DC shunt trip coil 110 volts DC spring release coil 110 volts (if XEM)	1 1
12.4	Auxiliary switches (see separate schedule)	1 set
12.5	Local manual trip button and indication of circuit breaker position	1
12.6	Local circuit breaker control switch GEC type RC pistol grip	1
12.7	Local/remote changeover switch GEC type RS	1
12.8	Fuse, links, terminal blocks and secondary wiring	As required
12.9	Current transformers class X for biased differential and restricted earth fault protection ratio	3
12.10	Current transformers class 30VA 5P10 for overcurrent protection and instruments ratio	3
12.11	Current transformers for 15VA class 0.5 for metering ratio	2
12.12	Current transformer 15VA class 0.5 for automatic voltage control ratio	1
12.13	Current transformers ratio 800/1 Class X for busbar protection (Main)	3
12.14	Current transformers ratio ..... Class X for busbar protection (Check). *Subject to agreement - may not be required for low impedence busbar protection schemes.	3*

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
12.15	Multicore/multipair terminations and glanding for terminating PVC insulated SWA and sheathed multicore/multipair cables NOTE: 1. Continuous thermal rating of current transformers to match rating of current breaker 2. The nominal current rating of the circuit breaker may be 2000A provided that evidence is available to substantiate a cyclic rating of 2360A to match a 90MVA transformer rating to IEC 76 and IEC 354.	1

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
12.16	Wall mounted control/relay cubicle 2000mm high 760mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	
	12.16.1 4" diameter ammeter, flush mounted, GEC Elite 4E Scale:-	1
	12.16.2 4" diameter MWatt/MVar meter, flush mounted, GEC Elite 4E Scale:- 40-0-140/40-0-140	1
	12.16.3 MWatt/MVar component box	1
	12.16.4 Changeover switch for MWatt/MVar meter Craig Derricott	1
	12.16.5 Indication lamps Highland Electronics 704 series (open, close, springs charged)	3
	12.16.6 Remote/Supervisory change over switch Craig and Derricott see WPD Data Sheet CS4	1
	12.16.7 Circuit breaker control switch, Pistol Grip (Craig and Derricott)	1
	12.16.8 Spring auxiliary switch repeat relay Clifford and Snell D2600/24 110V dc coil (if insufficient contacts are available)	1
	12.16.9 Circuit breaker close interposing relay Clifford and Snell D2600 see WPD Data Sheet 1	1
	12.16.10 Circuit breaker open interposing relay, Clifford and Snell D2600 see WPD Data Sheet 2	1
	12.16.11 Current transducer 1 amp, (see WPD Data Sheets 1 or 11)	3
	12.16.12 Phase angle transducer 1 amp, 110V ac input (see WPD Data Sheet 5 or 15)	1
	12.16.13 Voltage transducer 110V ac input (see WPD Data Sheet 4 or 14)	3
	12.16.14 Fuses, links, GEC Red Spot and labels	As required

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
	12.16.15Terminal blocks, Klippon RSF1 and, for 50V supervisory wiring, SAKR	As required
	NOTE:The following item to be provided if the current breaker utilises SF6 or if transformer has pressure relief alarm	
	Alarm relay GEC Type MVAA 21, 110/125V dc, two elements, self reset contacts, hand reset indicators on BOTH elements flush mounted, ring terminations for low gas pressure	1
	Contacts1M for alarm) 1B for interlock) SF6 relay 1B for spare) 3M for spare)	
	1M for alarm) Pressure relief 3M for spare) relay	

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
13	Bus Zone Protection High Impedance (One unit required per zone) Wall mounted/free standing relay cubicle 2000mm high 600mm wide 500mm deep equipped with the following:- Superseded by EE Spec 87	
13.1	Bus Zone high impedance relay 3 pole - 1 amp - 125V dc GEC type MCAG34 - 10-40%	1
13.2	Bus zone tripping relay 125V dc GEC type MVAJ13 Hand reset contacts hand reset indication	2
13.3	Busbar supervision and bus shorting relay 3 pole 1 amp 125V dc GEC type MVTP31	1
13.4	Indicating lamps for:- (i)Bus zone in commission(White) (ii)Bus zone out of commission (White) (iii)Bus zone defective (Orange)	3
13.5	Bus zone IN/OUT selector switch (additional contact made in OUT position for SWEDAT indication).	1
13.6	Fuses, links, GEC red spot and labels	As required
13.7	Terminal blocks Klippon RSF1 and SAKR for 50V supervisory wiring	As required
13.8	Wiring, labels, gland plates, etc	As required

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
14	Bus Zone Protection for use with High Impedance Scheme (One unit required for ALL zones) Wall mounted/free standing relay cubicle 2000mm high 600mm wide 500mm deep, equipped as follows: Superseded by EE Spec 87	
14.1	Bus zone phase and earth fault check relay. GEC type MCAG39 2-pole O/C 50/200% 1 pole EF 20/80%	2
14.2	Bus zone protection test and shorting link blocks GEC type series KP0004 - 001	As required
14.3	Fuses and links GEC red spot and labels	As required
14.4	Terminal blocks Klippon RSF1 and SAKR for 50V supervisory wiring	As required
14.5	Wiring label, gland plates, etc	As required

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
15	Low Impedance Busbar Protection Bus zone busbar check protection using the GEC Alsthom MBCH range of relays. Scheme to be designed to suit the specified busbar arrangement. Details of the scheme to be submitted at the time of tender by the tenderer and agreement reached with WPD prior to placement of the contract.	

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
16	**Structure Mounted Voltage Transformer**	
16.1	3 phase 5 limb wound type star/star/open delta connection. Ratio 33,000/110 volts 200VA per phase Class 1.0 6P accuracy. Residual winding 63.5 volts per limb 100VA, voltage factor 1.9 to BS 7625.	1
16.2	Terminal box - see Appendix C	1
16.3	Mounting channels - see Appendix C	1
	IMPORTANT NOTE Remember that VTs for settlement metering require a dedicated winding. See Clause 2.5.3	

SECTION 1B

SCHEDULE OF EQUIPMENT

Item No	Description	No. Reqd. per unit
17	Voltage supervision and changeover equipment to be mounted either in wall mounted sheet steel cubicle 600mm x 600mm x 30mm OR in bus-section control/ relay cubicle. This equipment can also be used at 33/11kV substation where two voltage transformers are employed.	
17.1	Voltage selection relay 'T bar' 807 magnetic latching relay model no 807-12-C-110 with 12 changeover contacts suitable for operation on 110/125V dc.	1
17.2	Connector kit for item 17.1 ref: 88601	1
17.3	Voltage buswire supervision relay midland automation type BJE0201	1
17.4	Voltage buswire alarm relay GEC MVAA11, flush mounted, ring terminations, 110/125V dc, self reset 6M contacts, hand reset indicator	1
17.5	Voltage selection ON/OFF selector switch Craig and Derricott 15A minirotary 2 pole refer R16D11/1/SK	1
17.6	Voltage selection illuminated push buttons Highland Electronics 04 series with clear indicators type PB1A to WPD data sheet 2	2
17.7	Voltage transducers 110V ac input see WPD data sheet 4 or 14	1
17.8	Terminal blocks Klippon RSF1 and, for 50V supervisory wiring, SAKR	As required
17.9	Fuses, links, GEC red spot, labels, wiring etc	As required
	NOTE**:** If system is earthed via arc suppression coil, voltage supervision relay to be Midland Automation type BCE0201	

APPENDIX F

SUPERSEDED DOCUMENTATION

EE SPEC: 10/1 dated December 1998

APPENDIX G

ASSOCIATED DOCUMENTATION

EA Technical Specification 41-36.

APPENDIX H

IMPACT ON COMPANY POLICY

Amendments made to the document to allow for pusher type ABSD's and their possible subsequent use.

During the next tender the following switches will be set up as standard across the business.

- 3ph - 11kV Cat 0 190MVA independent manual air break switch disconnectors
- 3ph - 33kV Cat 0 570MVA independent air break switch disconnectors
- 1ph & 3ph - 11kV Cat 2 60MVA manual dependent plain make break air break switch disconnectors

APPENDIX I

IMPLEMENTATION DATE

Immediate.

APPENDIX J

KEY WORDS

Open terminal, switchgear, circuit breaker, disconnector, fault thrower recloser, sectionaliser.

APPENDIX K

DOCUMENT LAST REVIEWED

February 2008

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