



GS 112-9

Guidance for Specification 112-9

HIGH VOLTAGE SWITCHGEAR AND CONTROL GEAR

June 1993

Copyright © The British Petroleum Company p.l.c.

All rights reserved. The information contained in this document is subject to the terms and conditions of the agreement or contract under which the document was supplied to the recipient's organisation. None of the information contained in this document shall be disclosed outside the recipient's own organisation without the prior written permission of Manager, Standards, BP International Limited, unless the terms of such agreement or contract expressly allow.

BP GROUP RECOMMENDED PRACTICES AND SPECIFICATIONS FOR ENGINEERING			
Doc. No. GS 112-9		Issue Date	June 1993
		Latest Amendment Date	
Document Title			
HIGH VOLTAGE SWITCHGEAR AND CONTROL GEAR (Replaces BP Engineerig Std 225)			
APPLICABILITY			
Regional Applicability:		International	
SCOPE AND PURPOSE			
This document specifies BP's general requirements for the design selection and testing of HV switchgear and control gear. It identifies the international standards that are applicable to HV Switchgear in context and further defines specific requirements from a range of options in the international standards that are necessary for BP			
AMENDMENTS			
Amd	Date	Page(s)	Description
CUSTODIAN (See Quarterly Status List for Contact)			
Control and Electrical Systems, ESS			
Issued by:-			
Engineering Practices Group, BP International Limited, Research & Engineering Centre Chertsey Road, Sunbury-on-Thames, Middlesex, TW16 7LN, UNITED KINGDOM			
Tel: +44 1932 76 4067		Fax: +44 1932 76 4077	Telex: 296041

CONTENTS

Section	Page
FOREWORD	iii
1. INTRODUCTION/GENERAL.....	1
1.1 Scope.....	1
1.2 Certification	1
1.3 Exceptions	1
1.4 Service Life.....	1
1.5 Rating.....	2
1.6 Quality Assurance	2
2. CIRCUIT-BREAKERS	2
3. FUSE PROTECTED CONTACTOR UNITS	2
4. DESIGN REQUIREMENTS	4
4.1 Enclosures	4
4.2 Partitions and Shutters	4
4.3 Busbars.....	6
4.4 Disconnectors (Isolators), Switches and Earthing Switches	6
4.5 Heaters	7
4.6 Internal Wiring and Marking	7
4.7 Provision for Installation of External Cables	9
4.8 Earthing.....	9
4.9 Interlocks.....	10
4.10 Locking Arrangements	10
4.11 Nameplates and Labels	10
4.12 Operating Mechanisms	11
4.13 Auxiliary Switches and Contacts.....	12
4.14 Test Facilities	13
4.15 Lifting and Moving Facilities	13
4.16 Special Tools and Equipment	13
4.17 Drawings.....	14
4.18 Operating and Maintenance Instructions	14
4.19 Painting.....	15
4.20 Spare Fixed Housings.....	15
5. COMPONENTS	15
5.1 Fuses and Fuse-Links	15
5.2 Indicating Instruments.....	16
5.3 Electrical Protective Relays	16
5.4 Current Transformers.....	17
5.5 Voltage Transformers	18
5.6 Indicating Lamps.....	18
5.7 Terminals.....	19
5.8 Control Devices	19



6. TESTING	20
6.1 General	20
6.2 Type and Routine Tests.....	20
6.3 Test Certificates	21
GENERAL REQUIREMENTS.....	22
SCHEDULE OF UNITS	23
CIRCUIT BREAKER.....	24
FUSE PROTECTED CONTACTOR UNIT	26
APPENDIX A.....	28
DEFINITIONS AND ABBREVIATIONS.....	28
APPENDIX B.....	29
LIST OF REFERENCED DOCUMENTS	29



FOREWORD

Introduction to BP Group Recommended Practices and Specifications for Engineering

The Introductory Volume contains a series of documents that provide an introduction to the BP Group Recommended Practices and Specifications for Engineering (RPSEs). In particular, the 'General Foreword' sets out the philosophy of the RPSEs. Other documents in the Introductory Volume provide general guidance on using the RPSEs and background information to Engineering Standards in BP. There are also recommendations for specific definitions and requirements.

Value of this Guidance for Specification

In identifying the international standards that are applicable to HV Switchgear in context and defining specific requirements from a range of options in the international standards that are necessary for BP installations, this Guidance for Specification enables consistent fit-for-purpose specification of equipment via easily understood data sheets.

Application

This Guidance for Specification is intended to guide the purchaser in the use or creation of a fit-for-purpose specification for enquiry or purchasing activity.

Text in italics is Commentary. Commentary provides background information which supports the requirements of the Specification, and may discuss alternative options. It also gives guidance on the implementation of any 'Specification' or 'Approval' actions; specific actions are indicated by an asterisk (*) preceding a paragraph number.

This document may refer to certain local, national or international regulations but the responsibility to ensure compliance with legislation and any other statutory requirements lies with the user. The user should adapt or supplement this document to ensure compliance for the specific application.

Specification Ready for Application

A Specification (BP Spec 112-9) is available which may be suitable for enquiry or purchasing without modification. It is derived from this BP Group Guidance for Specification by retaining the technical body unaltered but omitting all commentary, omitting the data page and inserting a modified Foreword.

Principle Changes from Previous Edition

This document replaces BP Engineering Standard 225 entitled High Voltage Switchgear and Controlgear, which was last amended in May 1986. It is written around the latest IEC standards for this equipment.



Feedback and Further Information

Users are invited to feed back any comments and to detail experiences in the application of BP RPSE's, to assist in the process of their continuous improvement.

For feedback and further information, please contact Standards Group, BP International or the Custodian. See Quartley Status List for contracts



1. INTRODUCTION/GENERAL

1.1 Scope

This Specification gives BP requirements for industrial type metal-enclosed switchgear and controlgear, based on the requirements of IEC 56 and IEC 298.

It covers a range of equipment for operation at potentials in excess of 1,000 volts up to and including 36,000 volts.

The switchgear and controlgear, referred to in this specification as the switchgear, shall be of factory-assembled, indoor, metal-enclosed type incorporating circuit-breaker or mixed assemblies of circuit-breakers and fused switching devices, which may incorporate disconnectors (isolators) or earthing switches.

It covers switchgear for application onshore and offshore. Mobile offshore installations may require further supplementary specification.

1.2 Certification

- 1.2.1 The complete switchgear assembly, including any adaptor units, components etc. shall have been type tested by a recognised testing authority at the required operating and short circuit duty in accordance with IEC 298 and other relevant IEC standards. Copies of certificates for each type and rating shall be included with quotations. This requirement applies to switching devices both in their service and earthing position.

1.3 Exceptions

- 1.3.1 A manufacturer shall state in his tender that the equipment offered complies with the requirements of this Specification without exception, or shall detail on the Data Sheets the exceptions against the section numbers of this Specification.
- 1.3.2 A manufacturer may offer alternative proposals for price or technical advantage if he wishes, but such proposals shall form a supplement to the main tender.

1.4 Service Life

- 1.4.1 The switchgear shall be designed for a service life of at least 20 years in the environment and for the duty specified on the Data Sheets.

It is traditional to specify a minimum 20 year life and manufacturers standard equipment is likely to meet this requirement. However, thought should be given to any special service life requirements.



1.4.2 The switchgear shall be suitable for a minimum of 3 years normal continuous operation without maintenance at the duty specified on the Data Sheets.

1.4.3 Equipment installed offshore may be subjected to shock and vibration associated with drilling and production facilities and to the deflection of the deck on which the switchgear is mounted. Equipment on mobile offshore installations needs to be suitable for operation whilst inclined (e.g. for trim or list), and additionally for acceleration, speeds and angles associated with vessel motion.

1.5 Rating

1.5.1 The switchgear ratings shall be as detailed on the Data Sheets and shall comply with the requirements of [IEC 298](#). The manufacturer shall state any derating allowances which apply to satisfy the specific site conditions.

1.5.2 Ratings shall not be dependent on the use of cooling fans.

1.6 Quality Assurance

Verification of the vendor's quality system is normally part of the pre-qualification procedure, and is therefore not specified in the core text of this Specification. If this is not the case, clauses should be inserted to require the vendor to operate and be prepared to demonstrate the quality system to the purchaser.

Further suggestions may be found in the BP Group RPSEs Introductory Volume.

2. CIRCUIT-BREAKERS

2.1 Circuit-breakers shall comply with [IEC 56](#) and shall be of the type, duty and rating specified on the Data Sheets.

Where the manufacturer proposes supplying a circuit-breaker with a different rating to that in the data sheet, agreement should be confirmed with the purchaser.

It is preferable that circuit breakers be designed such that they reach the closed position when making against the short circuit current specified on the Data Sheets.

2.2 Circuit-breakers shall be withdrawable.

3. FUSE PROTECTED CONTACTOR UNITS

3.1 Fuse protected contactor units shall be of the type specified on the Data Sheets.



- 3.2 Motor starters shall comply with [IEC 632](#).
- 3.3 Motor starters and contactor feeders shall be withdrawable.
- 3.4 Fuse protected contactor units shall incorporate an anti-pumping device.
- 3.5 Motor starters shall be rated for both uninterrupted duty and intermittent duty class 0.3 and have utilisation category AC-3 to [IEC 632-1](#).
- 3.6 Contactor feeders shall be rated for both uninterrupted duty and intermittent duty class 0.1 with utilisation category AC-3 to [IEC 632-1](#).
- 3.7 The co-ordination between starters or contactor feeders and associated short circuit protective devices shall comply with [IEC 632-1 Appendix B](#). The classification of acceptable damage shall be Type C to clause B4.1.
- When instantaneous earth fault protection is specified and Type C cannot be achieved a time delay may only be incorporated with BP approval.*
- 3.8 Contactors shall comply with [IEC 470](#).
- Contactors may be electrically-held or mechanically latched as specified on the Data Sheets. If neither is specified, then manufacturers should assume that electrically held contactors are to be supplied.*
- The preference is for the rated voltage of a.c. electrically held contactors to be 110 volts a.c. derived via a transformer from the circuit side of the main circuit isolating contacts.*
- If specified, mechanically latched contactors shall incorporate an electrical trip coil and a manual release. The manual release shall be guarded to preclude inadvertent operation. The power supply security for operating the electrical trip coil should be considered. Loss of this supply, would inhibit automatic and remote tripping. For the reason, as a minimum, it is recommended that the tripping supply is maintained. Consideration should be given to a battery supported power supply, and two sets of independently powered trip coils.*
- 3.9 SF₆ or vacuum contactors shall be arranged so that if the SF₆ or vacuum is lost they will open safely at the rated normal current and voltage duty.
- 3.10 Requirements for surge protection should be sought with the manufacturer, and provided as deemed necessary.



4. DESIGN REQUIREMENTS

4.1 Enclosures

- 4.1.1 The degree of protection shall be IP3X or better as defined in [IEC 298](#).

Consideration should be given to the design and construction of enclosures, such that they minimise the passage of flame, vapour or gases between compartments. This requirement applies to wiring ducts, riser chambers, etc.

- 4.1.2 Switchgear assemblies shall be extensible at either end.

Such extensions should be without the need to cut or drill any part of the equipment. It is preferable to erect extension units without isolating the already installed switchgear, until it is required to connect the busbars.

- 4.1.3 Spare cubicles/starters shall be completed to such an extent that future additional consumers can become operational without shutting down the switchboard.

- 4.1.4 When stated in the Data Sheet, test reports shall be provided confirming the switchboard capability of containing internal arcing faults in accordance with [IEC 298](#) Annex AA, Type A requirements. The Test Reports should confirm that the equipment satisfies test criteria No 1 and No 2. Such reports shall cover arcing faults upstream of short circuit interrupting devices, unless it can be demonstrated that such enclosure areas can be deemed 'fault free zones' by the use of all insulated components.

Containment of internal arcing faults is an important issue. The main concern relates to providing evidence that internal arcing faults within the enclosure will not result in personnel sustaining injury when operating, or in the vicinity of, equipment. It is recommended that test reports are requested, unless there is deemed to be a low risk to operators. Low risk situations may include, for example

- (a) *Where switchgear is installed in a remote substation, and access is infrequent.*
- (b) *Where switchgear is fuse supplied.*
- (c) *Where the switchgear prospective fault level is significantly lower than its certified fault rating.*
- (d) *Where fast acting busbar differential protection is used*

4.2 Partitions and Shutters

- 4.2.1 The partitions' and shutters' protection shall be IP3X or better as defined in [IEC 298](#).



- 4.2.2 Safety shutters shall automatically cover all busbar contacts whenever withdrawable parts are isolated or withdrawn.

Consideration needs to be given as to whether the automatic safety shutters shall also be provided to cover all circuit fixed isolating contacts. It is recommended that automatic safety shutters cover circuit fixed isolating contacts in the following instances:-

- (a) *Feeders where there is a possibility of back feeding onto the outgoing terminals (e.g. parallel transformers).*
- (b) *On motor feeders where there is no automatic application of circuit earth.*

- 4.2.3 Shutters shall be individually operated by movement of the withdrawable part. The opening and closing of the shutters shall be by a positive mechanical drive.

- 4.2.4 Shutters shall be arranged so that only those required for a particular operation are open.

- 4.2.5 Facilities for shutters to be padlocked closed shall be provided.

- 4.2.6 Means shall be provided for opening each set of shutters to facilitate testing. This means shall not prevent restoration of the automatic features of the shutters when the withdrawable part is replaced.

- 4.2.7 Shutters shall be coloured and labelled.

The preferred method for colouring and labelling shutters is:-

	Shutter Colour	Label	Letter Colour
<i>Busbars</i>	<i>Red</i>	<i>Busbars Danger...Volts</i>	<i>Black</i>
<i>Circuit</i>	<i>Yellow</i>	<i>Circuit Danger...Volts</i>	<i>Black</i>

Shutters for bus-section and bus-coupler circuit-breakers shall also be labelled with the busbar number. Additionally, for bus-section circuit breakers a white arrow shall be provided pointing towards the section of the busbar with which the shutter is associated.

4.3 Busbars

- 4.3.1 Busbars shall be hard-drawn high conductivity copper.

- 4.3.2 Busbars shall have the same current rating throughout the length of the switchgear assembly.



- 4.3.3 All high voltage busbars and connections shall be fully insulated. Insulation materials shall withstand without damage the effects of carrying the rated short-time withstand current of the switchgear.

Where deemed necessary, the busbars may be specified to be phase segregated. This should be stated on the Data Sheet.

- 4.3.4 Busbar joints and connections shall be corrosion-protected and secured to prevent loosening.
- 4.3.5 Means shall be provided to prevent arc propagation across bus-section switching units.
- 4.3.6 The numbering or colour coding of busbars is to be agreed with the manufacturer and included on the Data Sheet.

4.4 Disconnectors (Isolators), Switches and Earthing Switches

- 4.4.1 Isolators and earth switches shall comply with [IEC 129](#).
- 4.4.2 Switches shall comply with [IEC 265](#).
- 4.4.3 Disconnectors (isolators) shall be interlocked to prevent operation unless the circuit switching device is open.
- 4.4.4 All earthing switches shall be interlocked with the local circuit disconnector/switch.
- 4.4.5 Earthing switches shall have a rated short circuit making capacity no less than the rated asymmetrical (peak) making current specified on the Data Sheets.

Earthing switches associated with motor starters or fuse protected contactor units feeding capacitors do not need to have rated short-circuit making capacity equal or greater than the rated making current specified on the Data Sheet.

- 4.4.6 Automatic circuit earth switches should not be used on fused contactor transformer feeders.

4.5 Heaters

- 4.5.1 Equipment should be suitably designed for the environment so that anti-condensation heaters are not required.

In exceptional onerous environments heaters may be required. In such circumstances, the following shall apply:-

- (a) Heaters shall have minimum degree of protection IP 50 to [IEC 529](#).



- (b) *Heaters shall be suitable for operation at the voltage specified on the Data Sheets.*
- (c) *Heaters shall be wired to a common terminal block in each transportable assembly for connection to an external supply. These terminals shall be easily accessible when the assembly is packed for shipping. The heater wiring shall be arranged so that one common circuit can be provided when the switchgear is installed.*
- (d) *The switchgear assembly common heater circuit shall be provided with a double pole switch, fuse and link and an indicating lamp with a label engraved 'Heater Supply On'.*

4.6 Internal Wiring and Marking

- 4.6.1 Internal wiring conductors shall have minimum cross section of 1.5 mm² and a minimum of seven strands, unless otherwise approved by BP.

Consideration shall be given to wiring for current transformers. Normally, conductors with a minimum cross section of 4 mm² are used.

- 4.6.2 Not more than two wires shall be connected to any one terminal
- 4.6.3 Wiring for circuits connected to buswired power supplies shall be protected by fuses for each switchgear unit.
- 4.6.4 All control and internal wiring shall be easily identifiable and traceable throughout the circuit schematic and wiring diagrams.
- 4.6.5 Switchgear unit inter-wiring shall be carried within a duct.
- 4.6.6 Connections relying solely upon solder are not acceptable.
- 4.6.7 Conductor ends shall be fitted with a crimped terminating device with an insulating shank.
- 4.6.8 Where the application of microprocessor based systems would be supported by a different approach to internal wiring and marking, the specific arrangements should be agreed with BP.
- 4.6.9 Insulation other than PVC may be used subject to approval by BP.
- 4.6.10 Wiring shall be positively identifiable.



The following is preferred:-

Type of Wiring	Insulation Colour	Identification Ferrule Colour
a.c.	Black	Phases: Red, Yellow and Blue Neutral: None
d.c.	Grey	None
Earth	Green/Yellow	None
Circuits energised from outside the switchgear unit	Orange #	None

Colouring the insulation orange is the preferred method of identifying circuits that are energised from outside the switchgear unit. If this cannot be achieved, then the minimum requirement is that terminals associated with externally energised wires carry warning labels.

- 4.6.11 Wiring shall be fitted with interlocking numbered identification ferrules. Ferrules shall be fitted at both ends of the wire unless the wire is individually routed and is less than 100 mm long. Ferrules shall be indelibly marked. It shall be necessary to disconnect the termination to remove the ferrules. Paper ferrules are not acceptable.
- 4.6.12 Wiring across door hinges shall be protected against mechanical damage, preferably by the use of flexible conduits.
- 4.6.13 Switchgear unit inter-wiring ducts shall be accessible without the need for de-energising any circuits. Sufficient space shall be left in ducts and trunks for at least an additional 10% of wires to be installed.

4.7 Provision for Installation of External Cables

- 4.7.1 Separate terminal boxes shall be provided on each switchgear unit for the main and auxiliary circuit cables.

Manufacturers should be advised of cable, type and sizes for main and auxiliary circuits to ensure adequate space provision can be made. This is best done by completion of the Data Sheets. Consideration should also be given to the need for future cabling requirements.

The direction of cable entry also needs to be stated on the Data Sheet at the earliest opportunity.

- 4.7.2 Provision shall be made to support external cables.

Cable supports are recommended at intervals not exceeding 450 mm between the cable entry and top or bottom of the switchgear depending on the direction of cable entry.



- 4.7.3 Main circuit cable terminals shall have means of locking the connections. Space shall be allowed for crimped lug terminations.
- 4.7.4 Main and auxiliary circuit cables within an enclosure shall be segregated.
- 4.7.5 Undrilled gland plates shall be provided. Where single core cables are used, gland plates shall be non-ferrous.

Single core cables should be bonded at one end and insulated from earth at the other.

- 4.7.6 Terminals carrying different voltages shall be separated. The voltage shall be marked on the terminals.

4.8 Earthing

- 4.8.1 The switchgear earthing conductors shall be hard-drawn, high-conductivity copper, suitably marked.

The sizing of the switchgear earth conductors is explained in [IEC 298, 5.3.2](#). In practice, it is normal for these conductors to be 70 mm² or greater.

- 4.8.2 Joints in main earthing conductors shall give good electrical contact and be secure.

In order to achieve good electrical contact between earthing conductors, joints should be tinned and fixed with galvanised steel bolts, nuts and washers. Loosening should be prevented by lock nuts or other manufacturing standard.

Bonding connections between doors and frames should be arranged to prevent damage during door opening and closing.

- 4.8.3 Each switchgear unit shall have integral facilities for earthing the main circuit cable.

The preferred application of earths in circuit breaker compartments shall be by operation of the circuit breaker. In such cases, when closed in an earthing position, all circuit breaker electrical trips shall be inoperative.

Other methods of earthing may also be acceptable, provided they can be safely closed and opened by an operator. Earthing methods should be discussed at the earliest opportunity with prospective switchgear suppliers.

- 4.8.4 Integral earthing arrangements for each section of busbars shall be provided on each incoming circuit breaker and at the bus-section switch.



4.9 Interlocks

- 4.9.1 Interlock arrangements shall be as stated in [IEC 298, section 5.106](#). Mandatory interlocks shall be mechanical.

The minimum requirements are stated in [IEC 298](#). Additional requirements may be necessary, and these should be advised for project specific applications. The use of electrical interlocks for these additional applications should be agreed between manufacturer and purchaser at the earliest opportunity.

4.10 Locking Arrangements

- 4.10.1 The intent of padlocking provisions is stated in [IEC 298, section 5.106](#).

In order to achieve the intent of [IEC 298](#), it is expected that as a minimum provisions would be expected to padlock the following:-

- (i) doors closed*
- (ii) disconnectors (isolators) open*
- (iii) safety shutters closed (separate facility for busbar and circuit shutters)*
- (iv) earthing switches closed*
- (v) switching device control circuit local/remote selector switches in all positions*
- (vi) voltage transformers in the service position.*

4.11 Nameplates and Labels

- 4.11.1 Each unit of switchgear shall be identified with a label at the front and rear of the fixed part, marked with the circuit designation (rated normal current, description and connected equipment number) as specified on the Data Sheets.

These labels shall preferably be of stainless steel.

- 4.11.2 For each complete assembly, a purchaser's nameplate should be included, giving the following information:-

- (i) Purchaser's name*
- (ii) Order and item number*
- (iii) Date of order.*

Nameplates of stainless steel are preferred.

- 4.11.3 Labels shall be provided to identify the functions of main components.

The labels for identifying functions of equipment would be expected to be provided for the following:-

- (i) each control switch*
- (ii) each indicator lamp*



- (iii) each fuse and link
- (iv) selector switch positions
- (v) each instrument
- (vi) each relay.
- (vii) each heater.

Additionally, where two or more components of a particular type are incorporated, each individual component of that type shall be provided with a unique identification label.

Main circuit fuse-links shall have a label with the following information:-

- (i) manufacturer's designation
- (ii) type reference
- (iii) number of fuse-links per phase
- (iv) maximum current rating per phase

4.11.4 Danger labels shall be clearly discriminated by colour.

Danger labels with black lettering on yellow background to IEC 417 are preferred. Other labels and nameplates should preferably be black lettering on white background.

4.11.5 Terminal label markings shall comply with IEC 445.

4.11.6 Unless otherwise stated, all labels shall be in English.

4.12 Operating Mechanisms

4.12.1 Operating mechanisms shall:-

- (i) include an anti-pumping device.
- (ii) incorporate a local manual trip facility fitted with a guard to preclude inadvertent operation.
- (iii) give positive indication of switch position.

It is preferable that operating mechanisms incorporate direct-driven mechanical indication of the switching device position, to be visible from the switchgear front.

4.12.2 Operating mechanisms with electric closing shall have an interlock so that closing cannot be initiated when a trip condition exists.

4.12.3 Close and trip circuits shall be overcurrent protected.

The protection devices for trip and closing circuits need to be fully co-ordinated. Under all conditions, the protection device nearest the fault operates first without damaging or reducing life of other fuses or initiating operation of other protection devices.

4.12.4 It shall not be possible for the closing mechanism to operate if the trip circuit protection device is open circuit.



4.12.5 Circuit breaker motor-wound spring operating mechanisms shall be provided with means to charge the spring manually.

4.12.6 *It is preferable for operating mechanisms having short-trip circuits (ie. energise to trip) to be fitted with trip circuit supervision. This alarm should be inoperable when the switching device is isolated. The trip circuit wiring be arranged so that the supervising relay operates if any of the wiring becomes discontinuous. The relay is to monitor the trip circuit when the switching device is open or closed.*

4.13 Auxiliary Switches and Contacts

4.13.1 Control and auxiliary switches shall comply with [IEC 337](#).

4.13.2 Each switching device shall be provided with an auxiliary switch.

The auxiliary switches should preferably be provided in replaceable banks, be easily accessible for maintenance and also be fitted with dust-protecting covers.

The number of auxiliary contacts associated with the switching device are to be stated on the Data Sheets. These need to be wired to outgoing terminals, for use associated with plant control etc. It should be noted that these are in addition to those contacts necessary for switchgear internal control circuits.

Auxiliary switch contacts should preferably be of a type which can be individually re-arranged for 'normally-open' or 'normally-closed' operation.

Switchgear auxiliary circuits which derive their power supply from an external source should preferably be connected via auxiliary switch contacts so that circuits are de-energised when the switching device is isolated. If this cannot be achieved then the minimum requirement is for all cabling associated with externally powered circuits to be coloured differently from other cables. In addition, all associated terminals, lugs etc. shall be fully shrouded and labelled to the effect that they need to be isolated externally before being accessed.

4.13.3 The following main circuit circumstances shall have auxiliary switches:-

- (i) switching device in the service position.
- (ii) switching device removed from the service position.
- (iii) circuit earthed
- (iv) busbar earthed.

4.13.4 When specified on the Data Sheets, auxiliary switch contacts for motor heater supplies shall be provided so that heaters are energised when the main circuit switching device is open. When the switching device is isolated, the heater supplies shall be isolated

4.14 Test Facilities

4.14.1 Switching devices shall have the facility to be test-operated when isolated.



Test facilities for remote operation of switching devices should only be operable if the switching device is partially housed in its cubicle and does not permit physical injury to operators working at the switchgear.

4.14.2 Withdrawable switching devices shall be supplied with a test link to allow testing in the withdrawn position.

4.14.3 Facilities shall be provided for primary injection testing.

4.14.4 Each switchgear assembly shall incorporate pressure test facilities for busbars and all incoming and outgoing circuits. One set of any test plugs required for this purpose shall be supplied by the manufacturer.

The test plugs to be used must have been tested for the power frequency withstand voltage specified, when plugged in position.

4.14.5 Additional test equipment which may be supplied (eg. test blocks) should be discussed and agreed with the manufacturer.

4.15 Lifting and Moving Facilities

The method and equipment required for safely lifting transportable assemblies is best discussed with the manufacturer. Detailed instructions for lifting the switchgear should be included in the Operating and Maintenance Instructions.

4.16 Special Tools and Equipment

4.16.1 Requirements for special tools and equipment (including HV test probes) necessary for the erection, operation, testing and maintenance of the switchgear should be discussed with the manufacturer.

It is preferable, that items are supplied in a suitable padlockable box and the purpose of each tool and device labelled.

4.17 Drawings

4.17.1 The following is a guide to the requirements for drawings from the manufacturer:-

Each drawing supplied by the manufacturer shall incorporate the following information:-

- Manufacturer's name and address
- Drawing title (including location)
- Name of the project
- Manufacturer's order or contract number
- Purchaser's order number
- Manufacturer's drawing number and revision number



- Date of original issue and dates of any revisions with details.

The following drawings with associated time schedule to be provided.

- (a) *To be provided by the manufacturer with his quotation:-*
 - (i) *Outline drawing of the complete switchgear with its certified maximum dimensions and weight.*
 - (ii) *Typical schematic or circuit diagram for the control and protection circuits.*
- (b) *To be submitted by the manufacturer for approval at least 4 weeks before manufacture is started.*
 - (i) *Certified outline drawings showing dimensions and weight of each transportable unit, cable termination position, fixing details, withdrawal space and door swings where applicable, and floor impact loadings for circuit breakers.*
 - (ii) *Circuit wiring diagrams showing all connections and details (including cable sizes) with wiring identification numbers to enable all testing, calibration and fault tracing to be carried out.*
 - (iii) *Interconnection diagrams or schedules.*
- (c) *To be submitted by the manufacturer as soon as possible after the order is placed.*
 - (i) *Protection current transformer magnetisation curves.*

A separate circuit diagram shall be prepared for each different type of functional unit with space on each drawing for external circuitry to be shown.

4.18 Operating and Maintenance Instructions

4.18.1 Requirements for instructions needs to be discussed and agreed with the manufacturer.

The following is a guide to these:-

Maintenance instructions to include a detailed list of recommended spare parts for three years operation. (A separate list of recommended spares for installation and commissioning should also be provided.)

Installation and maintenance instructions to include torque loadings of all bolts used in busbar joints.

Within the operation and maintenance instructions 'critical tasks' should be identified.

In addition to those called for under the terms of the order, a complete set of installation, operating and maintenance instructions to accompany the equipment



when shipped. The location of these documents to be prominently displayed on the equipment.

4.19 Painting

- 4.19.1 The manufacturer's standard needs to be sought and normally agreed. This includes colour.

4.20 Spare Fixed Housings

- 4.20.1 Requirements for spare switchgear fixed housings need to be stated on the Data Sheets.

They should preferably be provided with the minimum equipment to permit future completion without de-energising the switchgear. Housings to be provided with doors or covers to complete the fronts of enclosures, together with labels indicating the maximum normal current rating.

5. COMPONENTS

5.1 Fuses and Fuse-Links

- 5.1.1 High voltage motor circuit fuses shall comply with either [IEC 282](#) or [IEC 644](#). All other high-voltage fuses shall comply with [IEC 282](#).
- 5.1.2 High-voltage fuse-switch combinations shall comply with [IEC 420](#).
- 5.1.3 High-voltage fused equipment shall incorporate means to trip the switching device after a fuse has operated.
- 5.1.4 Indication of high-voltage fuse operation shall be provided at the compartment front panel.
- 5.1.5 Low-voltage fuses shall comply with [IEC 269 Parts 1 and 2](#).

It is preferable that low-voltage link holders are self-coloured white, and low-voltage fuse holders are self-coloured black or red.

- 5.1.6 All unearthed poles of auxiliary supplies shall be fused. Earthed poles shall be connected via a link.
- 5.1.7 Earthing connections of auxiliary supplies and current transformers shall be removable for testing.

5.2 Indicating Instruments

- 5.2.1 Instruments shall be flush-mounted and comply with [IEC 51](#) class index 2.5.



5.2.2 External zero adjustment shall be provided on all instruments.

As a guide, ammeter scales need to be selected so that the full load current appears between 50% and 80% of normal full scale angular deflection.

If called for on the Data Sheets, instruments shall be provided with red index pointers or red lines at the settings specified. Red index pointers shall be adjustable by means of a tool.

Ammeters for motor circuit applications need to have suppressed upper scale readings to match the motor starting currents. If no other information is available then a suppressed scale to at least six times the range of the ammeter should be selected.

5.3 Electrical Protective Relays

5.3.1 Electrical protective relays shall comply with [BS 142](#) or other national standard approved by BP.

5.3.2 Protective relays shall be flush-mounted, drawout pattern and be mounted so as to be easily accessible from floor level.

Generally, all relays should be capable of being hand-reset from outside the relay case. In addition, it is normal for the relays to include operation indicators - which can be reset from outside the relay case.

5.3.3 For the purposes of testing, drawout relays shall be withdrawable with all circuits energised without open-circuiting current transformer secondaries or causing protective systems to operate.

5.3.4 Stud type relay terminals shall include locknuts.

5.3.5 Protection settings shall be self contained within the relay without possibility to change settings from a remote location.

5.3.6 Where microprocessor protection systems are called for on the Data Sheet this specification shall be read in conjunction with Project specific requirements for these protection/control devices.

Where microprocessor based protection relays are used, the protection settings should be retained within the relay without external power supply being available. Communication and control aspects associated with these relays will be contained in project specific documentation.

5.4 Current Transformers

5.4.1 Current transformers shall comply with [IEC 185](#).



5.4.2 Current transformers shall have a short time current rating at least equal to that of the switchgear or the let-through current of the main circuit fuse.

5.4.3 Current transformers shall be accessible safely without de-energising the busbars.

The exception to this may be current transformers associated with bus zone protection.

5.4.4 Current transformers secondaries shall be earthed at one point through a removable link.

5.4.5 Secondary windings shall be connected to terminals integral with the current transformer.

5.4.6 Current transformer circuit wiring connected to external circuits shall be provided with captive-type shorting links at the outgoing terminals.

5.4.7 CT requirements need to be identified on the Data Sheets. The rated primary currents preferred by [IEC 185](#) should generally be selected.

Specification of current transformers for protective relay applications are best discussed with manufacturers to ensure protective system discrimination and operation under all fault conditions.

Current transformers for metering generally shall be minimum accuracy Class 1 to [IEC 185](#) and the saturation shall be such that meters and instruments are not damaged during main circuit fault conditions.

Current transformers for remote ammeter operation generally need to be rated as a minimum 10VA and have minimum accuracy Class 3.

Consideration needs to be given to the physical size and location of ring type CTs in allowing cables to be withdrawn (including cable lugs and stress relieving equipment).

It is preferred that all current transformers used in association with protective relays fitted within the switchgear be either supplied by the protection relay manufacturer. This also applies to those current transformers which require to be mounted external to the switchgear.

Where appropriate, a label containing the name, type and manufacturer of the dielectric medium used shall be attached to the transformer to ensure ultimate safe disposal at the end of the working life.

5.5 Voltage Transformers

5.5.1 Voltage transformers shall comply with [IEC 186](#).



5.5.2 Voltage transformers shall be withdrawable, either separately or incorporated in a withdrawable part.

5.5.3 Voltage transformers primaries shall be protected by removable HRC fuses.

5.5.4 One pole of secondary windings shall be earthed.

VT requirements need to be identified on the Data Sheets. The nominal secondary voltage preferred is 110 volts between phases. The ratings preferred by IEC 186 should generally be selected.

Ratings should be selected such that the VT's are not loaded to more than 90% of their rated output.

Where reasonable, 3 phase voltage transformers shall be of the 3 limb-type and have star-connected primary and secondary windings.

They shall preferably be double wound and have an earthed metal screen between the windings.

Where appropriate, a label containing the name, type and manufacturer of the dielectric medium used shall be attached to the transformer to ensure ultimate safe disposal at the end of the working life.

5.6 Indicating Lamps

5.6.1 Colours for indicating lamps shall comply with [IEC 73](#).

The following arrangements are preferable:-

- (a) *Indicating lamps to be of flush mounting pattern, mounted so that they cannot rotate even if the retaining nut is not fully tightened.*
- (b) *Lamp holders and lenses to be designed to dissipate continuously the heat produced by the largest lamp that can be fitted, without deterioration or discolouration.*
- (c) *All lamps operating at the same voltage to be interchangeable.*
- (d) *Lamps operating at different voltages not to be interchangeable.*
- (e) *Lamp nominal voltages to be at least 110% of the nominal supply voltage.*

5.7 Terminals

Arrangements should be discussed with the manufacturer.

The following arrangements are preferable, although push quick fit devices may also be acceptable:-

- (a) *Terminals of either the screw clamp or the stud type be provided for the connection of all wiring. Pressure plates be incorporated such that*



neither screws nor nuts bear directly on to wiring. Securing arrangements to incorporate a locking feature.

- (b) Screw clamp type terminals be arranged such that only one conductor is secured by one screw clamp. Multiple connections at one point shall be effected by means of cross connecting links when screw clamps are used.*
- (c) All wiring terminated on to stud type terminals to be fitted with straight shanked compression type cable lugs.*
- (d) Terminals to be provided for the termination of external cabling. Separate entries to be provided for internal and external connections. The terminals to be installed to facilitate easy access for terminating, testing, inspection and maintenance.*
- (e) Terminals provided for external connections exceeding 6mm² to be suitable for straight shanked compression type cable lugs.*
- (f) Each and every terminal to be identified by means of an engraved, embossed or similar type of permanent marker.*
- (g) Terminals in circuits operating at voltages of 110V and above to be shrouded unless interlocking precludes live access.*
- (h) Terminal blocks with shrouds to be grouped by operating voltage and each group shall be labelled 'Danger volts'. Terminal blocks for tripping supplies to additionally be labelled 'tripping supply'.*

5.8 Control Devices

5.8.1 Contactor relays shall comply with [IEC 947-5-1](#).

5.8.2 Push-buttons and related control switches shall comply with [IEC 947-5-1](#).

5.8.3 All push-button switches shall have a full shroud to prevent inadvertent operation.

5.8.4 All units incorporating a contactor shall be fitted with an externally mounted stop push-button.

Generally, stop push-buttons to be of stay-put type, manually reset and coloured red. Where provided, stay-put stop devices when in the stop position, shall prevent closing of the switching device. The operating manual shall indicate clearly that the use of the stop push button for isolating purposes is not acceptable.

5.8.5 The rated thermal/breaking capacities of contacts need to be rated for their application.

Without additional information, these should be specified as:-

1A at 500 V a.c. and 0.3 power factor.



1A at 110 V d.c. inductive.
2A at 60 V d.c. inductive.

6. TESTING

6.1 General

- 6.1.1 The manufacturer shall certify that the design of the switchgear has been successfully tested by a recognised testing authority at the specified short circuit duty. Certificates shall be provided for each type and rating of switchgear offered.

6.2 Type and Routine Tests

- 6.2.1 Switchgear of each type and rating shall have been type tested in accordance with [IEC 298](#).
- 6.2.2 The switchgear shall be subjected to routine tests in accordance with [IEC 298](#) at the manufacturer's works.
- 6.2.3 Circuit-breakers of each type and rating shall have been type tested in accordance with [IEC 56-4](#).
- 6.2.4 Circuit-breakers shall be subjected to the routine tests in accordance with [IEC 56-4](#) at the manufacturer's works.
- 6.2.5 Motor starters and contactor, fuse and isolator combinations shall be tested in accordance with [IEC 632](#) and shall include the special tests to verify Type C co-ordination detailed in Appendix B of [IEC 632](#).
- 6.2.6 Contactors shall be tested in accordance with [IEC 470](#).
- 6.2.7 Disconnectors (isolators) shall be tested to [IEC 129](#).
- 6.2.8 A switch of each type and rating shall have been type-tested in accordance with [IEC 265-1](#).
- 6.2.9 Switches shall be subjected to the routine tests in accordance with [IEC 265-1](#) at the manufacturer's works.
- 6.2.10 Voltage transformers of each type and rating shall have been type tested in accordance with [IEC 298](#). Voltage transformers shall be subject to the routine-tests of [IEC 186 and 186A](#).
- 6.2.11 Current transformers shall be type and routine-tested in accordance with [IEC 185](#).



- 6.2.12 Instruments and other ancillary equipment shall be type and routine-tested in accordance with the applicable IEC Standard.
- 6.2.13 Handling devices, lifting tackle, test and maintenance equipment shall be type and routine tested, marked and certified as required by the IEC regulations.
- 6.2.14 Type tests that are necessary to meet the requirements of this specification should preferably be witnessed by a BP representative.
- 6.2.15 Routine tests to be witnessed by BP representative should be agreed with the manufacturer.

The routine tests detailed below should preferably be witnessed:-

- (i) Power frequency voltage test ([IEC 298](#))
- (ii) Main circuit resistance measurement ([IEC 56](#), [IEC 265](#)).
- (iii) Auxiliary circuit voltage tests ([IEC 298](#)).
- (iv) Dielectric tests ([IEC 632](#)).
- (v) Operation tests of protective relays and circuits by primary injection of current or voltage as required.
- (vi) Mechanical operation tests ([IEC 298](#), [IEC 56](#)).
- (vii) Operation tests ([IEC 632](#))
- (viii) Check of wiring ([IEC 298](#)).
- (ix) Interchangeability test.

6.3 Test Certificates

The manufacturer shall provide certificates for all tests.

The test certificates are to include values of results of tests.

It is preferred that test certificates for tests witnessed by BP representative are available for signature on the day of the test.



SCHEDULE OF UNITS

[illegible]

INDENT/PURCHASE ORDER NUMBER										
TO BE COMPLETED IN BLOCK CAPITALS										
TO BE COMPLETED BY PURCHASER										
GENERAL SYSTEM CHARACTERISTICS & REQUIREMENTS										
1	INSTALLATION SITE									
2	PLANT IDENTIFICATION									
3	LOCATION				ONSHORE			OFFSHORE		
4	SERVICE CONDITIONS IF EXCEEDING IEC 298				ALTITUDE			m		
					TEMP. MAX.			C		
					AV.			C		
					MIN.			C		
5	ONE LINE DIAGRAM No.									
6	SYSTEM NOMINAL RATING				kV		Ph		Hz	
7	SYSTEM HIGHEST VOLTAGE				kV					
8	SYSTEM NEUTRAL EARTHING				DIRECT			RESISTANCE		
9	RATED INSULATION LEVEL				AS IEC-298 TABLE 11					
10	BUSBAR SYSTEM									
	- RATED THERMAL CURRENT				A					
	- RATED ASYMMETRICAL (PEAK) MAKING CURRENT				kA					
	- RATED TRANSIENT WITHSTAND CURRENT				A		1s		3s	
	- PHASE SEGREGATED				YES			NO		
	- ARRANGEMENT				SINGLE			DUPLICATE		
	- IDENTIFICATION				NUMBERED			COLOUR CODED		
11	VOLTAGE TRANSFORMER				NO		RATIO		VA	
12	CLOSING CIRCUIT SUPPLY									
13	TRIPPING CIRCUIT SUPPLY									
14	HEATER SUPPLY									
15	LABEL LANGUAGE				ENGLISH					
16	EQUIPMENT COLOUR									
	- PAINT SPEC. APPROVED				YES			NO		
PUR. REMARKS		NONE		ATTACHED		TO BE COMPLETED BY MANUFACTURER				
						MAN.REMARKS		NONE		
REV	DATE	REMARKS	BY	APP	GENERAL REQUIREMENTS					
INDENT/PURCHASE ORDER NUMBER										



TO BE COMPLETED IN BLOCK CAPITALS					
TO BE COMPLETED BY PURCHASER					
1	NUMBER OF POLES		3		
2	RATED NORMAL CURRENT		A		
3	OPERATING SEQUENCE		0 - CO - CO		
4	INTERRUPTING MEDIUM		VACUUM	SF6	AIR
5	CLOSING MECHANISM		DC SOLENOID		PNEU. ACTUATOR
			DIRECT MANUAL		MOTOR DRIVEN
6	RATED ASYMMETRICAL (PEAK) MAKING CURRENT		kA		
7	RATED SHORT CIRCUIT BREAKING CURRENT		RMS COMPONENT		kA
			% dc COMPONENT		%
8	SPARE AUXILIARY SWITCHES				
	- MAIN SWITCHING DEVICE		N\	V	Hz
9	CONTROL - LOCAL CLOSE		YES	NO	MANUAL
	- LOCAL OPEN		YES	NO	MANUAL
	- REMOTE CLOSE		YES	NO	MANUAL
	- REMOTE OPEN		YES	NO	MANUAL
10	CIRCUIT SHUTTERS		YES		NO
11	METAL CLAD		YES		
TO BE COMPLETED BY MANUFACTURER					
12	OPENING TIME		s		
13	BREAK TIME		s		
14	CLOSING TIME		s		
15	N\ OF BREAKS PER POLE		1		
16	TRIP FREE OPERATION		YES		
17	TRIP MECHANISM				
	- TYPE				
	- RATED SUPPLY		V	A	
18	MIN. AIR CLEARANCES				
	- BETWEEN POLES		mm		
	- TO EARTH		mm		
19	MASS OF CIRCUIT BREAKER COMPLETE WITH INSULANT		kA		
20	TYPE TEST CERT. N\				
	- COPY INCLUDED		YES		
21	OVERALL DIMENSION DRAWING N\				
	- COPY INCLUDED		YES		
22	FOUNDATION DRAWING N\				
	- COPY INCLUDED		YES		
23	CONTROL CIRCUIT LOADS				
	- NORMAL		A		
	- SPRING CHARGE		A		
	- TRIP/CLOSE		A		
REV	DATE	REMARKS	BY	APP	

CIRCUIT BREAKER
 Page 1 of 2



INDENT/PURCHASE ORDER NUMBER							
TO BE COMPLETED IN BLOCK CAPITALS							
TO BE COMPLETED BY				PURCHASER		MANUFACTURER	
PROTECTION RELAYING							
						TYPE/SPEC'N.	
1	IDMTL OVERCURRENT	YES	NO				
2	INST. OVERCURRENT	YES	NO				
3	UNDERVOLTAGE	YES	NO				
4	BUCHOLZ TRIP	YES	NO				
5	RESTRICTED EARTH FAULT	YES	NO				
6	UNRESTRICTED EARTH FAULT	YES	NO				
7							
8							
9							
10							
11							
12							
13	CURRENT TRANSFORMERS						
	- FOR ITEMS:	No.	: RATIO	VA			
	- FOR ITEMS:	No.	: RATIO	VA			
INSTRUMENTATION AND METERING							
						TYPE/SPEC'N.	
14	LOCAL AMMETER	YES	NO				
	- WITH POINTER	YES	NO		A	SCALE	
15	REMOTE AMMETER	YES	NO				
16	VOLTMETER	YES	NO				
	- WITH POINTER	YES	NO		V	SCALE	
17	POWER FACTOR METER	YES	NO				
18	INTEGRATING WATTMETER	YES	NO				
19	BUCHOLZ ALARM	YES	NO				
20	HOURS RUN	YES	NO				
21	OPERATIONS COUNTER	YES	NO				
22	HEALTHY TRIP SUPPLY	YES	NO				
23							
24							
25							
26	CURRENT TRANSFORMERS						
	- FOR ITEMS:	No.	: RATIO	VA			
	- FOR ITEMS:	No.	: RATIO	VA			
PUR. REMARKS		NONE	ATTACHED	MAN. REMARKS		NONE	ATTACHED
REV	DATE	REMARKS	BY	APP	CIRCUIT BREAKER		



INDENT/PURCHASE ORDER NUMBER											
TO BE COMPLETED IN BLOCK CAPITALS											
TO BE COMPLETED BY PURCHASER											
1	NUMBER OF POLES				3						
2	RATED NORMAL CURRENT				A						
3	INTERRUPTING MEDIUM				VACUUM		SF6		AIR		
4	CONTACTOR TYPE				ELEC. HELD		LATCHED				
5	RATED ASYMMETRICAL (PEAK) MAKING CURRENT										
6	SPARE AUXILIARY SWITCHES - MAIN SWITCHING DEVICE										
					No		V		Hz		
					No		V		dc		
7	CONTROL - LOCAL CLOSE				YES		NO		MANUAL		
	- LOCAL OPEN				YES		NO		MANUAL		
	- REMOTE CLOSE				YES		NO		MANUAL		
	- REMOTE OPEN				YES		NO		MANUAL		
8	CIRCUIT SHUTTERS				YES		NO				
9	METAL CLAD				YES						
TO BE COMPLETED BY MANUFACTURER											
10	OPENING TIME										
11	MIN. AIR CLEARANCES										
	- BETWEEN POLES										
	- TO EARTH										
12	CLOSING SUPPLY INTEGRAL				YES						
	- RATING				V		A		Hz		
13	TRIP SUPPLY INTEGRAL				YES		NO				
	- RATING				V		A		Hz		
14	MASS OF UNIT COMPLETE										
15	TYPE TEST CERT. No										
	- COPY INCLUDED				YES						
16	OVERALL DIMENSION DRG. No										
	- COPY INCLUDED				YES						
17	FOUNDATION DRG. No										
	- COPY INCLUDED				YES						
PUR. REMARKS		NONE		ATTACHED		MAN. REMARKS		NONE		ATTACHED	
REV	DATE	REMARKS	BY	APP	FUSE PROTECTED CONTACTOR UNIT Page 1 of 2						



INDENT/PURCHASE ORDER NUMBER							
TO BE COMPLETED IN BLOCK CAPITALS							
TO BE COMPLETED BY				PURCHASER		MANUFACTURER	
PROTECTION RELAYING							
						TYPE/SPEC'N.	
1	IDMTL OVERCURRENT	YES	NO				
2	INST. OVERCURRENT	YES	NO				
3	UNDERVOLTAGE	YES	NO				
4	BUCHOLZ TRIP	YES	NO				
5	RESTRICTED EARTH FAULT	YES	NO				
6	UNRESTRICTED EARTH FAULT	YES	NO				
7							
8							
9							
10							
11							
12							
13	CURRENT TRANSFORMERS						
	- FOR ITEMS:	No.	: RATIO	VA			
	- FOR ITEMS:	No.	: RATIO	VA			
INSTRUMENTATION AND METERING							
						TYPE/SPEC'N.	
14	LOCAL AMMETER	YES	NO				
	- WITH POINTER	YES	NO	A	SCALE		
15	REMOTE AMMETER	YES	NO				
16	VOLTMETER	YES	NO				
	- WITH POINTER	YES	NO	V	SCALE		
17	POWER FACTOR METER	YES	NO				
18	INTEGRATING WATTMETER	YES	NO				
19	BUCHOLZ ALARM	YES	NO				
20	HOURS RUN	YES	NO				
21	OPERATIONS COUNTER	YES	NO				
22	HEALTHY TRIP SUPPLY	YES	NO				
23							
24							
25							
26	CURRENT TRANSFORMERS						
	- FOR ITEMS:	No.	: RATIO	VA			
	- FOR ITEMS:	No.	: RATIO	VA			
PUR. REMARKS		NONE	ATTACHED	MAN. REMARKS		NONE	ATTACHED
REV	DATE	REMARKS	BY	APP	FUSE PROTECTED CONTACTOR UNIT		

Page 2 of 2



DEFINITIONS AND ABBREVIATIONS**Definitions**

Standardised definitions may be found in the BP Group RPSEs Introductory Volume.

Definitions listed in IEC or British Standards shall apply. Definitions listed in IEC 56 and IEC 298 shall take precedence over other definitions.

Abbreviations

BS	British Standard
IEC	International Electrotechnical Commission
HRC	High rupturing capacity
SF ₆	Sulphur hexafluoride
SI	Système Internationale d'Unités



LIST OF REFERENCED DOCUMENTS

A reference invokes the latest published issue or amendment unless stated otherwise.

Referenced standards may be replaced by equivalent standards that are internationally or otherwise recognised provided that it can be shown to the satisfaction of the purchaser's professional engineer that they meet or exceed the requirements of the referenced standards.

International Standards

IEC 51 (EN 60051)	Direct acting indicating analogue electrical measuring instruments and their accessories.
IEC 56	High-voltage alternating current circuit-breakers.
IEC 73 (pr EN 60073)	Colours of indicator lights and push-buttons.
IEC 129	Alternating current disconnectors (isolators) and earthing switches.
IEC 185	Current transformers.
IEC 186	Voltage transformers.
IEC 265	High-voltage Switches
IEC 269, Parts 1 and 2 (EN 60269)	Low-voltage fuses.
IEC 282	High-voltage fuses.
IEC 298 (pr HD 187 S5)	AC metal enclosed switchgear and control gear for rated voltages above 1kV and up to and including 52kV.
IEC 947-5-1	Control circuit devices and switching elements.
IEC 417	Graphical symbols for use on equipment
IEC 420	High-voltage a.c. switch-fuse combinations.
IEC 445 (EN 60445)	Identification of equipment terminals and of terminations of certain designated conductors, including general rules of an alphanumeric system.



IEC 470	High-voltage a.c. contactors.
IEC 529 (EN 60529)	Degree of protection provided by enclosures.
IEC 632	High-voltage motor starters.
IEC 644 (pr EN 60644)	High-voltage fuse-links for motor circuit applications.

British Standards and Codes

BS 142	Electrical protection relays.
--------	-------------------------------

