



Document No.	GIS 12-103
Applicability	Group
Date	7 July 2003

Guidance on Industry Standard for High Voltage Switchgear & Controlgear (IEC)

GIS 12-103

**BP GROUP
ENGINEERING TECHNICAL PRACTICES**

Foreword

This is the first issue of Engineering Technical Practice (ETP) GIS 12-103. This Guidance on Industry Standard (GIS) is based on the following heritage documents from merged BP companies:

BP RPSE

GS 112-9

Guidance for Specification 112-9 High Voltage Switchgear and Control Gear

Uncontrolled Copy

Copyright © 2002, BP Group. 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 organization. None of the information contained in this document shall be disclosed outside the recipient's own organization without the prior written permission of Manager, Standards, BP Group, unless the terms of such agreement or contract expressly allow.



Table of Contents

	Page
Foreword	2
1. Scope	4
2. Normative references	4
3. Design, materials and fabrication	5
3.1. General	5
3.2. Enclosures	5
3.3. Busbar	5
3.4. Provisions for external cable	6
3.5. Earthing	6
3.6. Interlocks	7
3.7. Locking arrangements	7
3.8. Circuit breakers	7
3.9. Fuses and fuse-links	8
3.10. Fuse protected contactor units	8
3.11. Disconnectors (Isolators), switches and earthing switches	9
3.12. Auxiliary switches and contacts	9
3.13. Test facilities	10
3.14. Indicating instruments	10
3.15. Protective relays	11
3.16. Current transformers	11
3.17. Voltage transformers	12
3.18. Indicating lamps	12
3.19. Terminals and terminations	12
3.20. Control devices	13
3.21. Control	13
3.22. Internal wiring and marking	14
3.23. Heaters	15
3.24. Nameplates and labels	15
3.25. Special tools and equipment	16
4. Testing and inspection	16
4.1. Type and routine tests	16
4.2. Test certificates	17
5. Drawings and data requirements	17
6. Shipping	18

1. Scope

This GIS document provides guidance on industry standard for the design, materials, fabrication, inspection, testing, documentation, and preparation for shipment of high voltage switchgear and controlgear.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

International Electrotechnical Commission (IEC)

IEC 60044-1	Instrument transformers – Part 1: Current transformers
IEC 60044-2	Instrument transformers – Part 2: Voltage transformers
IEC 60051	Direct acting indicating analogue electrical measuring instruments and their accessories - All Parts
IEC 60073	Basic and safety principles for man-machine interface, marking and identification
IEC 60255	Electrical relays - All Parts
IEC 60269-1	Low-voltage fuses - Part 1: General requirements
IEC 60269-2	Low-voltage fuses Part 2: Supplementary requirements for fuses for use by authorized persons (Fuses mainly for industrial application)
IEC 60282-1	High-voltage fuses - Part 1: Current-limiting fuses
IEC 60298	AC Metal enclosed switchgear and control gear for rated voltages above 1 KV and up to and including 52 KV
IEC 60417	Graphical symbols for use on equipment
IEC 60445	Identification of equipment terminals
IEC 60470	High-voltage alternating current contactors and contactor-based motor-starters
IEC 60529	Degrees of protection provided by enclosures.
IEC 60644	High-voltage fuse-links for motor circuit applications
IEC 60694	Common specifications for high-voltage switchgear and controlgear standards
IEC 60947-5-1	Low-voltage switchgear and controlgear – Part5-1: Control circuit devices and switching elements – Electromechanical control circuit devices
IEC 61233	High-voltage alternating current circuit breakers – inductive load switching
IEC 62271-100	High-voltage switchgear and controlgear - Part 100: High-voltage alternating current circuit breakers
IEC 62271-102	High-voltage switchgear and controlgear - Part 102: Alternating current disconnectors and earthing switches
IEC 62271-105	High-voltage switchgear and controlgear - Part 105: Alternating current switch-fuse combinations

3. Design, materials and fabrication

3.1. General

Switchgear and control gear shall comply with IEC 60694.

3.2. Enclosures

3.2.1. General

- a. Switchgear shall be metal-clad with an enclosure rated IP 3X or better as defined by IEC 60298 and IEC 60529.
- b. Switchgear shall be extendable at either end without cutting or drilling any part of enclosure.
- c. Containment of internal arcing faults shall conform to IEC 60298 Annex AA, Type A requirements. Test reports shall confirm that equipment satisfies test criteria No. 1 and No. 2. 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 use of all insulated components.

3.2.2. Partitions and shutters

- a. Partitions and shutters protection shall be IP 3X or better as defined by IEC 60298.
- b. Automatic safety shutters shall cover fixed isolating contacts
- c. Shutters shall be individually operated by withdrawable part.
- d. Shutters shall be opened and closed by a positive mechanical drive.
- e. Facilities shall be provided to padlock shutters closed.
- f. Means shall be provided to facilitate testing shutters.
- g. Shutters shall be coloured and labelled in accordance with Table 1.

Table 1

Equipment	Shutter Colour	Label	Letter Colour
Busbars	Red	Busbars Danger...Volts	Black
Circuit	Yellow	Circuit Danger...Volts	Black

3.3. Busbar

- a. Busbar shall be hard-drawn high conductivity copper and comply with IEC 60439-2.
- b. Busbar shall have same current rating, throughout length of switchgear assembly.
- c. Busbar and connections shall be insulated. Insulation materials shall be flexible and able to withstand, without damage, effects of rated short time withstand current.
- d. Busbar joints and connections shall be corrosion-protected, secured to prevent loosening and discharge-free.
- e. Means shall be provided to prevent arc propagation across bus-section switching units.
- f. No wiring shall be contained within busbar compartments, other than phase and neutral connections to incoming and outgoing main circuits.

- g. Segregation barriers shall be provided along horizontal busbars, and between horizontal and vertical busbars. The preferred spacing is 1 m.

Spacing between segregation barriers along horizontal busbars should be discussed with the manufacturer at the time of enquiry. The intent of these barriers is to limit the spread of debris produced by a fault from spreading throughout the switchboard.

- h. Bus phasing shall be A, B, C left to right, top to bottom, and front to back viewed from front of switchgear. Busbar insulations shall be marked red, yellow, or blue according to the phase and black for neutral.
- i. Where bus duct is used to connect two or more sections of switchgear or motor control center, the continuous ampere rating, momentary rating, and bus bracing shall equal or exceed similar ratings of main bus.
- j. Horizontal and vertical bus shall be sized as specified on the data sheet
- k. Momentary duty rating and bus bracing for motor control centers shall exceed the maximum available fault current specified on drawings and/or data sheets.
- l. Covers providing access to busbars shall carry a "caution, risk of electric shock" symbol.
- m. Current rating of neutral busbars shall be at least 50% of corresponding phase busbars.

3.4. Provisions for external cable

- a. Separate terminal boxes shall be provided for main and auxiliary circuit cables.
- b. Provision shall be made to support external cables at intervals not to exceed 450 mm between cable entry and top or bottom of switchgear.
- c. Main circuit cable terminals shall have means of locking connections.
- d. Main and auxiliary circuits within an enclosure shall be segregated.
- e. Undrilled gland plates shall be provided.
- f. Gland plates shall be non-ferrous for single core cables.
- g. Terminals carrying different voltages shall be separated.
- h. Voltage rating shall be marked on terminals.

3.5. Earthing

- a. Switchgear earth conductors shall be sized in accordance with IEC 60298.
- b. Switchgear earthing-conductors shall be hard-drawn, high-conductivity copper, suitably marked.
- c. Joints in main earthing conductors shall be tinned, provide good electrical contact and be secure.
- d. Bonding between doors and frames shall be arranged to prevent damage during door movement.
- e. Switchgear units shall have integral facilities for earthing main circuit cable.

The preferred method of earthing circuit breaker compartments shall be by operation of circuit breaker. When closed in an earthing position, circuit breaker electrical trips shall be inoperative. Subject to agreement between the purchaser and the manufacturer during the enquiry stage, other methods of earthing may be acceptable provided they can be safely closed and opened from outside the circuit breaker panel.

- f. Integral earthing for each section of busbar shall be provided on incoming circuit breakers and at bus-section switches.