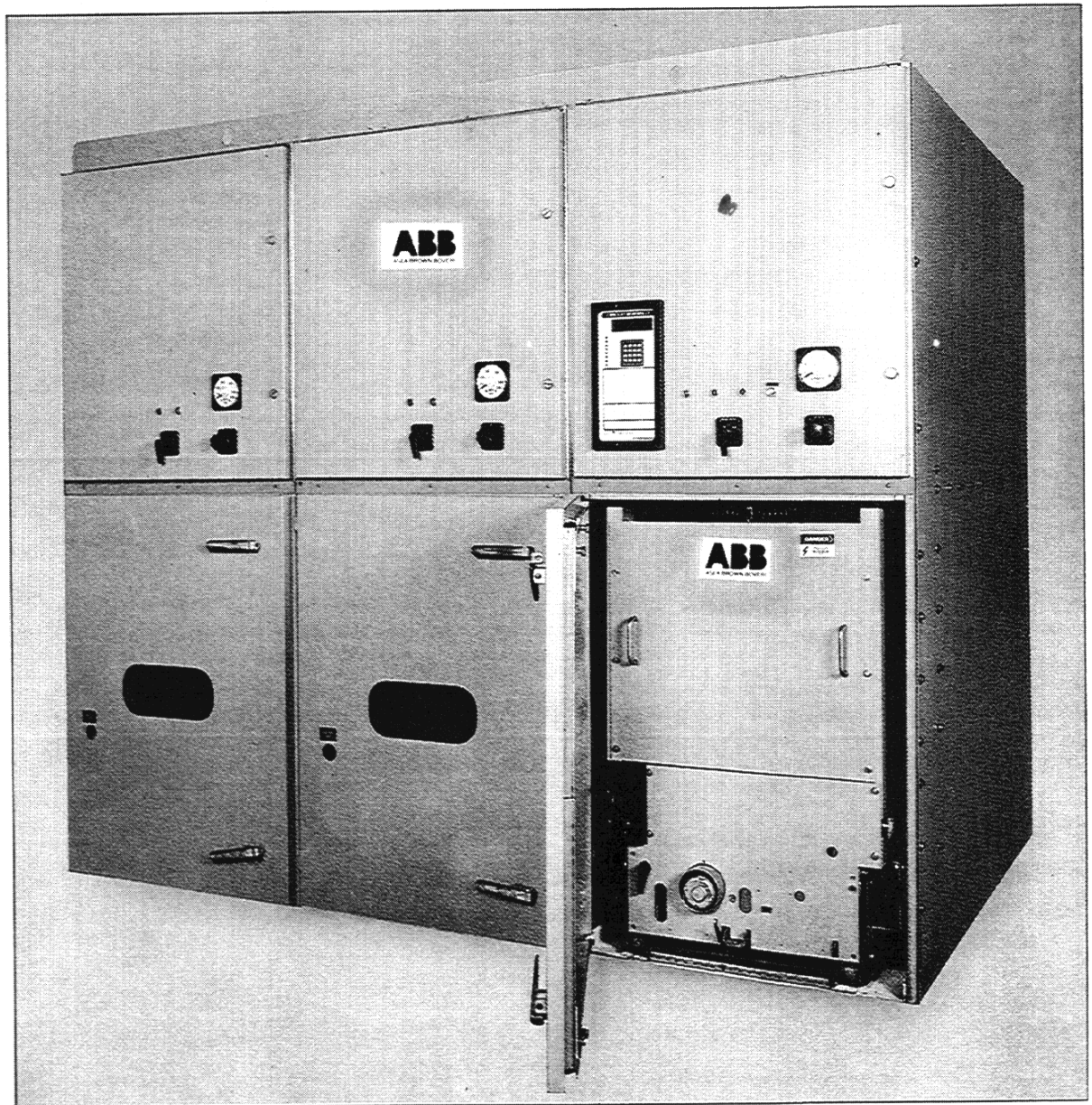




Arc-Proof, Metal-Clad
Medium Voltage Switchgear
ABB Type HKA
7.2kV to 34.5kV
1200-3000 Amperes

Publication No. BBCAN PD 10.3.3.0-TD-E



Introducing ABB Type HKA Arc-Proof Metal-Clad Switchgear

Initially developed to meet the requirements for arc-proof construction for some of ABB's major customers, ABB type HKA arc-proof metal-clad switchgear is now available as an economically viable option to all classes of users where safety of operating personnel is of overriding importance.

Type HKA metal-clad switchgear is a new, modular type, line of medium voltage switchgear completely designed, developed and manufactured in Canada, to meet the latest arc-proof requirements of IEC Standard 298. Prototypes of the new design have been fully and successfully tested in accordance with this standard.

Why Consider Arc-Proof Construction?

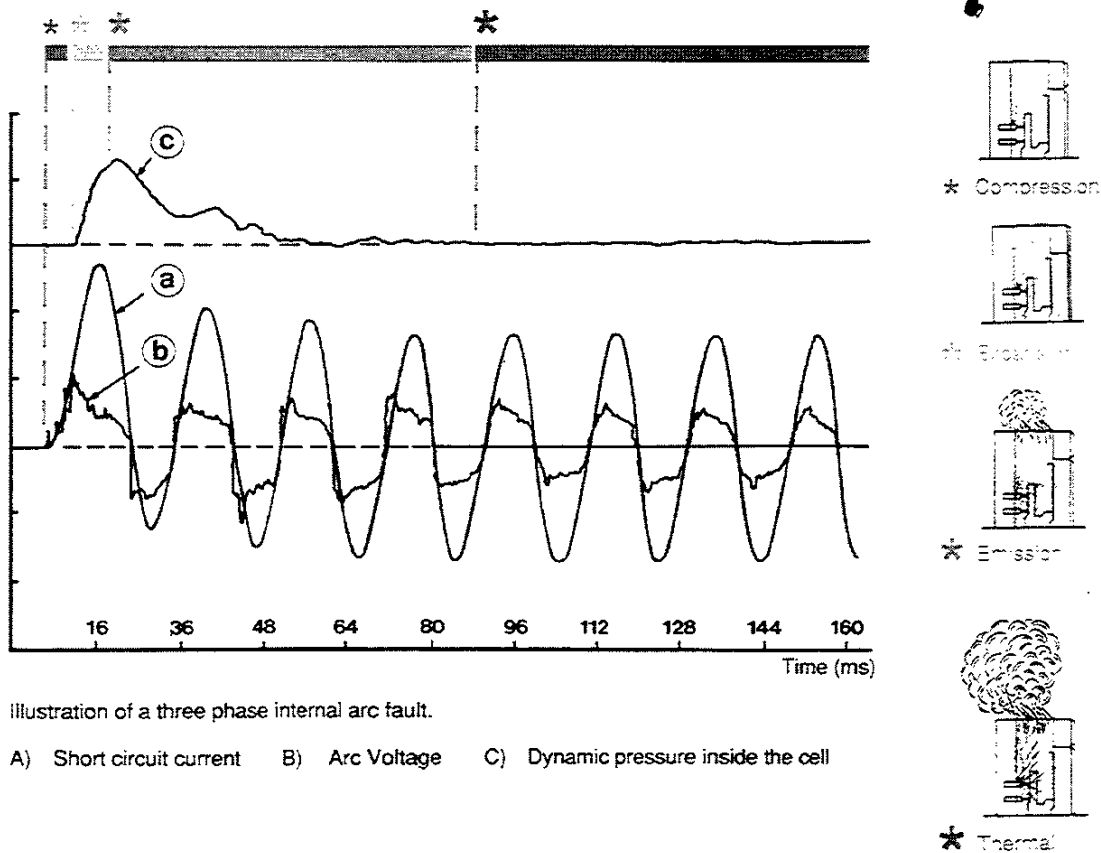
While there is little probability of failure within a metal-clad switchgear enclosure which meets the normal

standards of CSA, EEMAC, and ANSI, and receives proper maintenance, the possibility of such a failure, due either to a defect, an exceptional service condition or a maloperation, may initiate an internal arc and cannot therefore be completely disregarded. The effects of such an arc are becoming more significant with the trend to higher short circuit levels in recent years.

Should an arc fault develop, energy from the arc will cause a rapid build-up of explosive pressure within the cubicle due to the vaporisation of metals and the extremely high temperatures created. Unless the enclosure is designed to withstand the effects of an arc fault, such an event may lead to the risk of serious injury to personnel.

ABB'S TYPE HKA ARC-PROOF SWITCHGEAR HAS BEEN DESIGNED WITH THE OBJECTIVE OF PROVIDING THE HIGHEST POSSIBLE DEGREE OF PROTECTION TO THE USER'S OPERATING PERSONNEL.

The diagram below illustrates the sequence of events that occur following the initiation of a three phase internal arc fault.



What is Arc-Proof Construction?

Since it is not practical to contain the extremely high pressure within the enclosure during an arc fault condition, arc-proof construction allows this pressure to be relieved by the use of pressure relief vents at suitable locations in the switchgear. The intent of this design is to direct any hot gases to an area away from the operator such as up through the roof of the switchgear and towards the middle, rather than the front or rear.

The front doors, rear and side panels are designed, secured and tested to ensure that they withstand the potentially high pressures without being blown from the cubicle or allowing dangerous hot gases to be released to the front, rear or sides of the switchgear.

Because the gases are directed into the atmosphere, the switchgear design should not be looked at in isolation, but as a package which includes the building and its ventilation system.

Features of ABB Type HKA Switchgear

Arc-Proof Construction

Each cell is of arc-proof metal-clad construction.

Flexible Modular Design

The modular design, employing standard switchgear units, allows switchgear configurations to be provided which meet user's individual requirements without special engineering development or testing.

Ready Alignment of Breaker Contacts

The circuit breaker is racked in on a set of rollers separate from the breaker wheels, raising the breaker slightly off the floor. This guarantees positive alignment and proper mating of the primary, secondary and ground contacts.

Closed Door Safety

The breaker can be racked into or out of the fully connected position with the arc-proof door closed and latched. Furthermore, the breaker is physically restrained in its position by the cranking guide mechanism.

These two features combined provide the maximum protection to the operator.

Interlocks

The switchgear is complete with all the standard interlocks. In addition the racking mechanism is interlocked with the main shaft such that the main shaft must be rotated to the "open" position prior to any racking of the breaker.

Secondary Stationary Control Contacts

The contacts are mounted at the upper front of the breaker. These are self-aligning and visible when the breaker is installed in the cell. The terminals of the secondary contacts are accessible through the control compartment, and this also minimizes the amount of control wiring in the breaker compartment.

Shutter

Grounded metal shutter covering primary leads is forced closed as the breaker is moved from the test to disconnect position.

Current Transformers

The current transformers are mounted on the primary bushings behind the protective metal shutter. They are of the economical 600 volt primary insulation class. A maximum of 2 standard accuracy type C.T.'s can be mounted on each primary bushing, for a maximum of 12. Special high accuracy C.T.'s are limited to 1 per bushing for a maximum of 6.

If additional C.T.'s are required we can supply bus mounted line voltage C.T.'s.

Potential Transformer Units

The fused potential transformers are mounted in an arc-proof drawout compartment, with the following features:

- Arc-proof door of the same basic design as the breaker compartment.

- The drawer has three distinct positions, connected, disconnected and withdrawn. In the connected and disconnected positions the door may be closed. In withdrawn position, with the door open, the fuses may be removed.

- Sliding type secondary contacts.

- Automatic safety shutter.

- Where required, the P.T.'s can be inverted to provide better access to the P.T.'s and their fuses.

Main Bus Insulation System

Tin plated bus bars are coated with a flame retardant, track resistant epoxy insulation and pass through an interframe bushing which is mounted on a polyester bus support. Silver plated bus bars are available as an option.

General Description

Compact ABB medium voltage, arc-proof, metal-clad, drawout switchgear type HKA, consists of standard units suitable for use with the complete family of ABB type HKSA sulphur hexafluoride circuit breakers. The equipment can optionally be equipped with vacuum circuit breakers.

Modern insulating materials with high strength-to-weight ratio allow for reduction in weight and floor space.

Ratings

Nominal Voltage (kV)	Maximum Rated Voltage (kV)	Rated Continuous Current (A)	Insulation Level		
			BIL (kV)	Dielectric Strength (kV)	Corona Extinction (kV)
7.2	8.25	1200-3000A*	75	26	5.5
13.8	15.0	1200-3000A*	95	36	10.5
27.6	29.8	1200-2500A*	125	60	19.0
34.5	38.0	1200-2000A*	150	70	26.5

Note: 27.6 kV switchgear is available at 150 kV BIL, 70 kV Dielectric Strength, and 26.5 kV Corona Extinction.

* For higher current ratings consult your nearest ABB sales office.

Standards

The equipment is manufactured in accordance with the latest applicable standards of CSA, EEMAC, ANSI, NEMA, IEEE and IEC 298 amendment No. 2.

Quality Assurance

ABB Medium Voltage Switchgear Division, realizes the full importance of maintaining high quality standards in all its products.

In order to reach its quality goals, the Medium Voltage Division operations are conducted in compliance with the requirements of CSA Standard Z 299.2 - "QUALITY CONTROL PROGRAM REQUIREMENTS". Approval to this standard includes formal acceptance of manufacturers Quality Manual and Inspection and Test Plan(s).

In order to be totally effective, the ABB Quality Control Program is in operation continuously, while the level of monitoring activity may vary depending on specific contractual commitments. ABB has been audited by independent auditors and the Quality Control Program has received their approval to the Z 299.2 level.

ABB mandate is to ensure delivery to the customer of the finest quality products that can be manufactured. ABB success over the years in meeting this commitment speaks for itself. ABB will continue to provide the finest quality products providing many years of safe and trouble-free operation.

ABB Metal-Clad Switchgear designed for safety and reliability

- Arc-proof construction per IEC 298.
- Closed-door horizontal drawout of circuit breaker.
- Safe, positive interlocking of circuit breaker.

- Coordinated insulation system for each voltage class.
- Simplified maintenance.
- Most compact switchgear in many ratings.
- All parts easily accessible.

Four nominal voltage classes of HKA switchgear 7.2 kV, 13.8 kV, 27.6 kV and 34.5 kV, are available in both indoor and outdoor construction.

Painting

ABB standard paint process consists of a three stage wash using a solution of iron phosphate and additional cleaning agents to remove all traces of grease, oil or dirt. A gas fired pre-drying oven is followed by a powder booth where a thermosetting dry powder is electrostatically applied. This coating is cured in a gas fired oven at about 660°C to produce a finished thickness of 1.5 to 2.0 mils. Standard colour is ASA #61 Grey. Other colours are available.

The total system meets CGSB 31-GP-121 and specifications of major Canadian Electrical Utilities.

Accessories

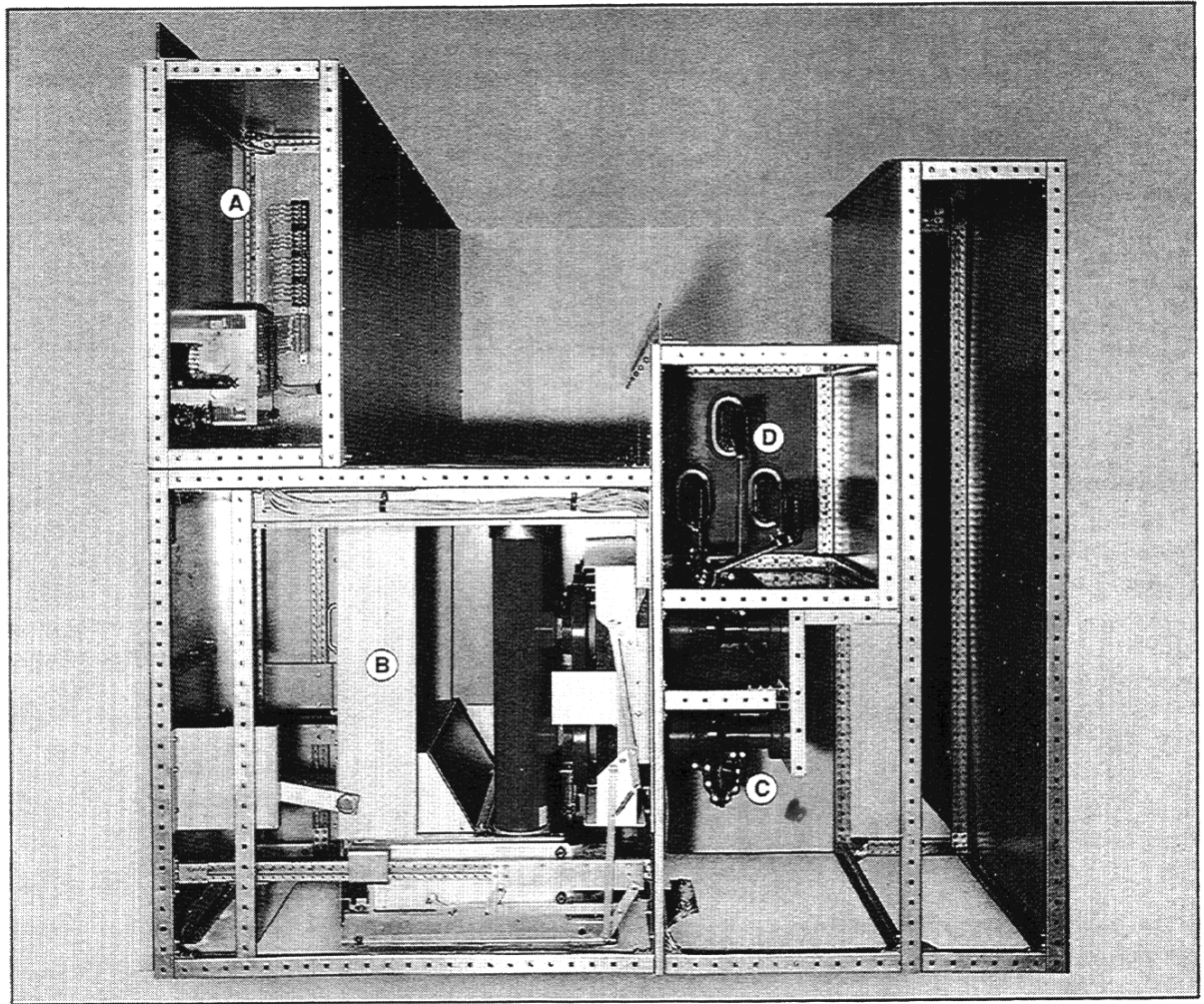
Standard

- Lifting angles.
- Electrical diagrams and installation manuals.
- Circuit breaker accessories.

Optional

- Base channels.
- Ground and test device (with or without making capability).
- Test cabinet for testing the circuit breaker outside the switchgear.

Arrangement of basic unit



Safe Compartmentation - complete accessibility of all components

Between switchgear frames there are steel side sheets, shown here cut-away to illustrate compartmentation. This unit is divided into completely segregated areas, with front formed doors.

A - Instrument compartment

- Provision for customer control cable (top entrance).
- Terminal blocks for interwiring between units and for connection of control cables.
- Wiring for the circuit breaker secondary circuits and all other control circuits.
- Auxiliary relays, and control devices.
- CT short-circuiting blocks.
- Auxiliary (MOC) contacts operated by the breaker mechanism for closed/open indication.
- (TOC) contacts operated by the breaker-truck for breaker "connected" position indication (optional).
- Instruments, relays, and control switches.

B - Breaker compartment

- Provision for customer control cable (bottom entrance).
- Positive steel safety shutter and actuator, automatically operated by the breaker-truck.
- Circuit breaker.
- Stationary secondary disconnect.
- Front removable current transformers up to 15kV - 2000A.

- "Arc-proof" front door operated by two handles.
- Arc exhaust sacrificial flaps.
- Ground bus.

C - Cable compartment

- Removable rear panels or hinged door.
- Epoxy insulated risers.
- Cable lug termination (1 per phase std.).
- Zero sequence current transformer (optional).
- Ground bus (optional).
- Arc exhaust sacrificial flaps.

D - Bus compartment

Accessible from the rear and top.

- Main bus supports embedded in a polyester glass sheet.
- Bus joint boots.
- Arc exhaust sacrificial flaps.

Different frame configurations are available to meet the requirements of each customer's needs. See following pages for typical switchgear frames available.

7.5kV to 15kV - 1200A and 2000A Main Bus

Main or feeder breaker frame with bottom cable entry only.

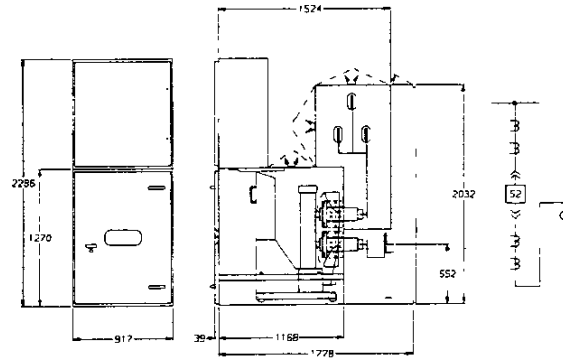


Fig. 1

Main or feeder breaker frame with bottom cable entry and ground sensor.

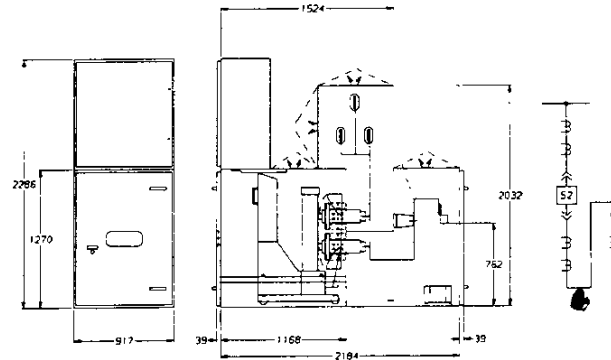


Fig. 2

Main or feeder breaker frame with pothead for bottom cable entry only.

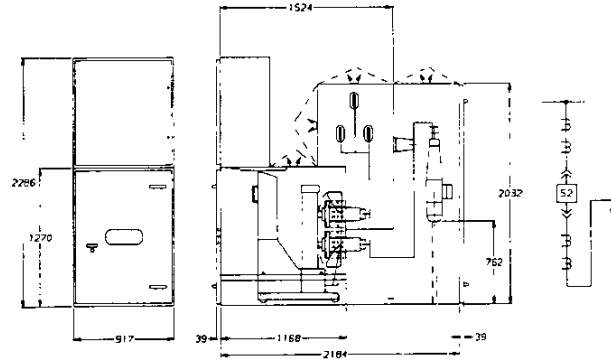


Fig. 3

Main or feeder breaker frame with two potheads for bottom cable entry only.

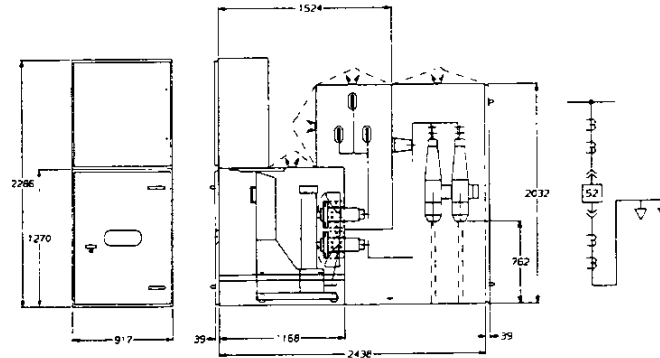


Fig. 4

7.5kV to 15kV - 1200A and 2000A Main Bus

Main or feeder breaker frame with bottom cable entry only, provision for ground sensor and potential transformer draw-out unit.

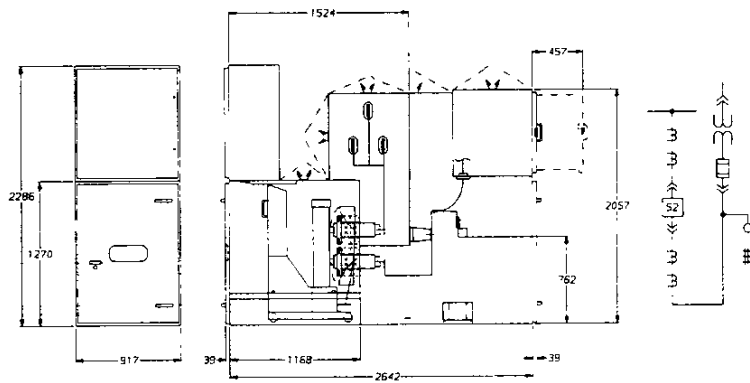


Fig. 5

Main or feeder breaker frame with top cable entry, provision for ground sensor and potential transformer draw-out unit connected to the main bus.

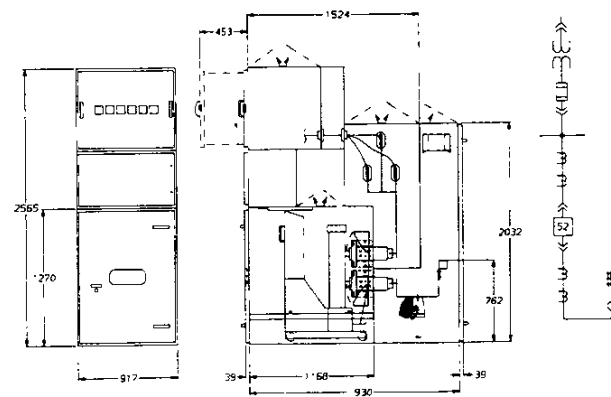


Fig. 6

Main or feeder breaker frame with potheads for bottom cable entry, and potential transformer draw-out unit connected to the main bus.

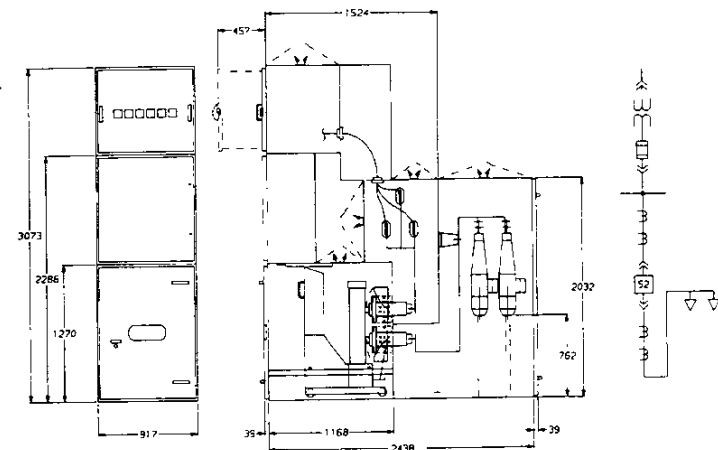


Fig. 7

7.5kV to 15kV - 1200A and 2000A Main Bus

Main or feeder breaker frame with potheads for bottom cable entry and potential transformer draw-out unit connected to the pothead side.

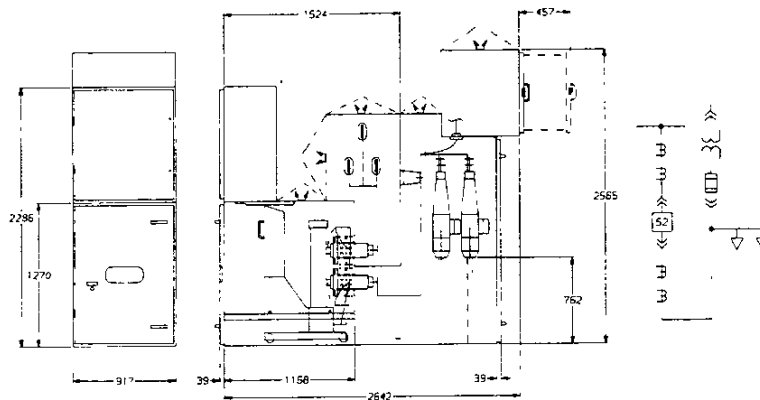


Fig. 8

Main bus tie breaker frame.

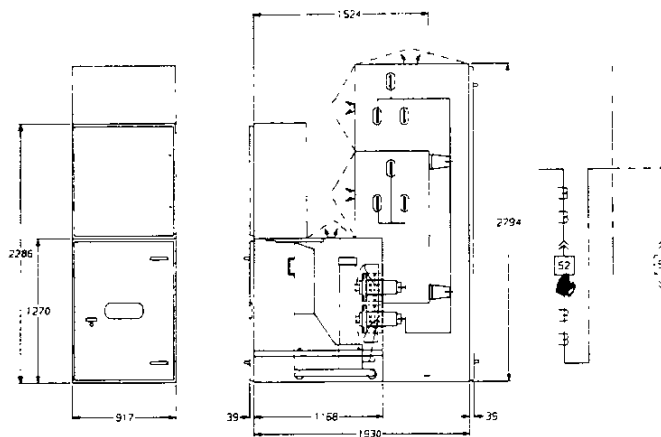


Fig. 9

Auxiliary services frame.

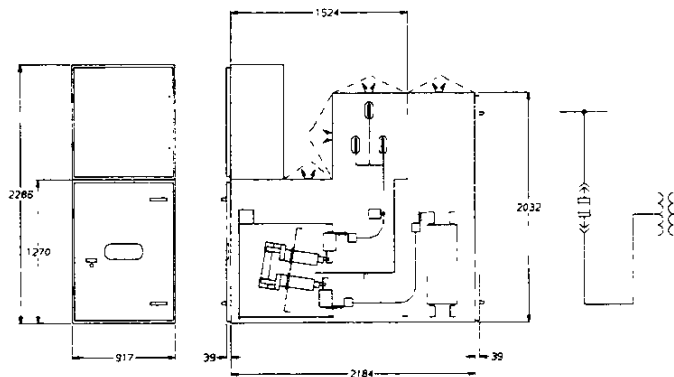


Fig. 10

Note: Figures 1 to 10 are typical 7.5kV to 15kV with main bus ratings of 1200 or 2000A. Main bus ratings are available up to 4000A. Dimensions shown are not to be used for construction purposes. For additional information contact your nearest ABB Sales Office.

25kV to 36kV - 1200A thru 3000A Main Bus

Main or feeder breaker frame with pothead for bottom cable entry.

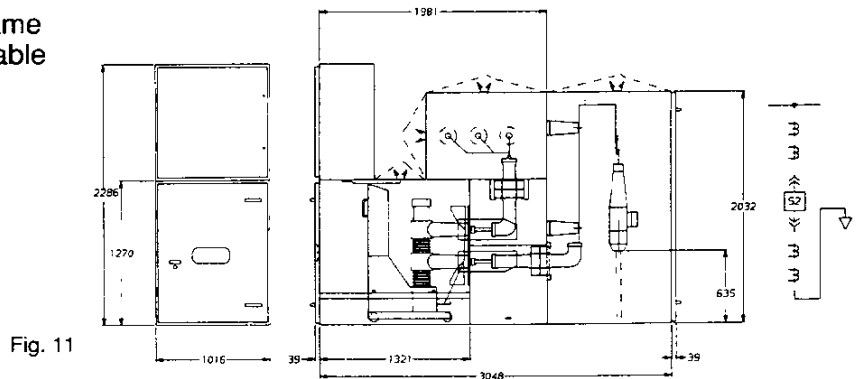


Fig. 11

Main or feeder breaker frame with cable lugs for bottom cable entry and potential transformer drawout unit connected to the main bus.

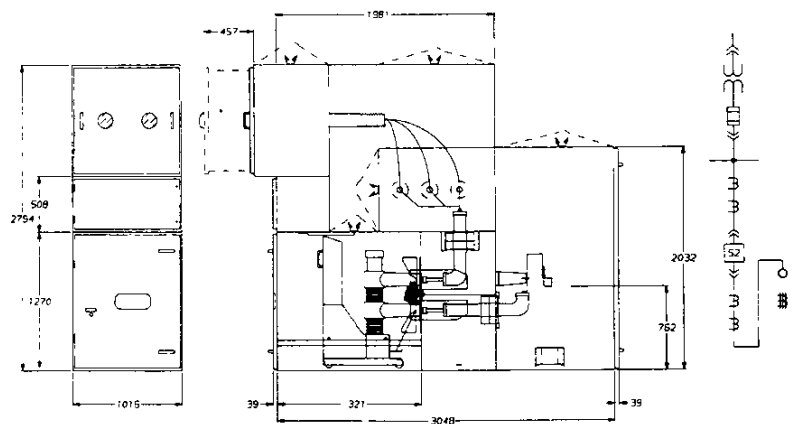


Fig. 12

Main or feeder breaker frame with cable lugs for top cable entry and ground sensor provision.

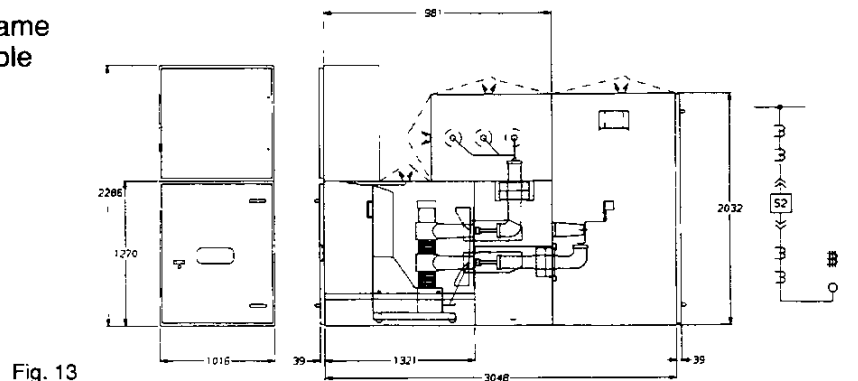


Fig. 13

Note: Figures 11 to 13 are typical 25KV to 36KV frames with main bus of 1200A, 2000A or 3000A. Due to the modular design of the frame, other frame configurations are available. The 7.5KV to 15KV frame configurations shown on prior pages can be used as further reference for 25KV to 36KV frames. Dimensions shown are not to be used for construction purposes. For additional information contact your nearest ABB Sales Office.

Type HKSA SF-6 Circuit Breakers

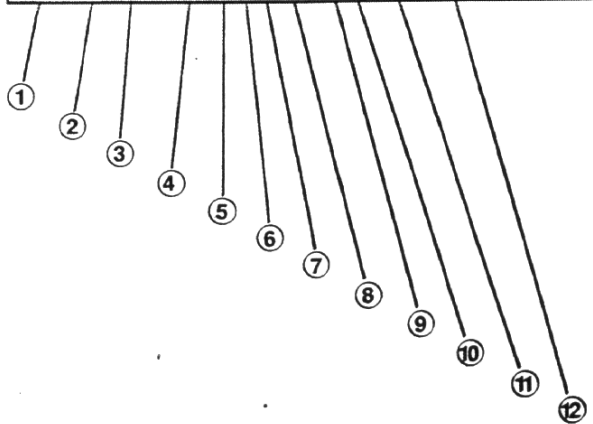
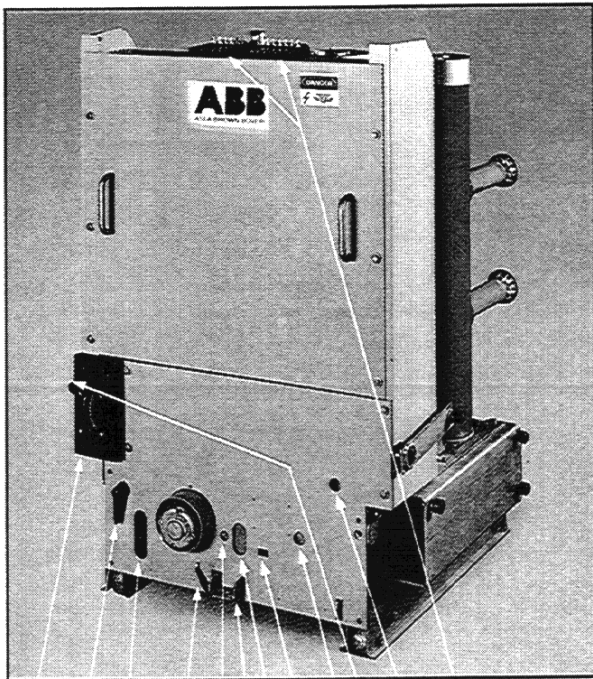
The Asea Brown Boveri sulphur hexafluoride puffer type circuit breaker, type HKSA is the result of combining two established designs. (The SF-6 gas interrupter units of the ABB SACE type SFA circuit breaker and the spring operating mechanism and modified truck components of the ABB type HK air magnetic circuit breaker.) Consequently, component parts are fully service proven and extensive test data already exists. The breaker is not interchangeable with existing type HK air magnetic and HKS SF6 circuit breakers.

Salient Characteristics

- Insulation and breaking guaranteed by sulphur hexafluoride (SF-6) through autopneumatic blast.
- Reduced maintenance, with capability of carrying out a large number of operations.
- Total reliability and autonomy.
- Capability of carrying out quick reclosing.
- Breaking operations with short arc durations and limited overvoltages even with small inductive or capacitive currents.
- Compact and sturdy construction.
- Easy installation.
- Official test certificates of independent laboratories.

The type HKSA circuit breakers are suitable for:

- Distribution circuits.
- Transformer substations.
- Large capacity capacitor banks and transformers.
- Motors, etc.



Breaker Accessories

The following accessories are supplied as standard for all breakers except as noted:

Fifth wheel
Slow-close bar
Racking crank assembly
Gas pressure testing gauge
(optional)

Manual charging handle
Breaker lifting yoke
Test jack and plug
(optional)

Operating Voltage Range

Nominal Control Voltage	Spring Coil Motor	Close Coil	Trip Coil	Under Voltage	
				Pick-Up Maximum	Drop-Out
* 24 V DC	-	-	14-30	21	7-14
48 V DC	† 35-50	35-50	28-60	41	15-29
125 V DC	90-130	90-130	70-140	106	38-75
250 V DC	180-260	180-260	140-280	212	75-150
115 V AC	95-125	95-125	‡95-125	98	35-96
230 V AC	190-250	190-250	‡190-250	196	69-140

Notes:

* Unless the circuit breaker is located close to the battery and protective relay and adequate electrical connections are provided between the battery and trip coil, 24 volt DC tripping is not recommended.

† 48 VDC spring charging is not recommended.

‡ AC tripping is not recommended. (Capacitor trip preferred)

Approximate Net Weights

Circuit Breaker	Nominal Current	Weight (Kg)
7.5 HKSA 500	1200	255kg
	2000	355kg
	3000	375kg
15 HKSA 500	1200	245kg
	2000	340kg
	3000	360kg
15 HKSA 750	1200	255kg
	2000	355kg
	3000	375kg
25 HKSA 1000	1200	320kg
	1600	325kg
	2000	385kg
	2500	405kg
36 HKSA 1600	1200	330kg
	1600	335kg
	2000	395kg

Features

1. Racking in/out mechanism
2. Manual trip
3. Manual spring charge
4. Manual close release lever
5. On-off power switch of motor
6. Support to accept fifth wheel
7. Local electric close and trip push buttons (optional)
8. Operation counter
9. Open-closed flag indication
10. Padlock provision
11. Springs charged-discharged flag indication
12. Automatic self-aligning secondary contacts

Table 1
7.5HKSA, 15HKSA and 36 HKSA - Sulphur hexafluoride (SF-6) power circuit breakers

Ratings on a symmetrical basis per ANSI

Type of Breaker	Nominal Rating		Δ Rated Continuous Current 60 Hertz AMPS-RMS	Rated Voltages			Insulation Level Rated Withstand		Interrupting Ratings † AMPS-Symmetrical			A symmetrical O Rating Factor	Short Time Rating 3 Sec AMPS-RMS	Close and Latch Rating AMPS-RMS	Interrupting Time Cycles
	Three-Phase MVA	Voltage KV-RMS		Maximum Voltage KV-RMS	K-Factor Max KV Min KV	Minimum Voltage KV-RMS	Low Frequency KV-RMS	Impulse Δ 1.2x50 MS KV-Crest	Maximum KV AMPS-RMS	Nominal KV AMPS-RMS	Minimum KV AMPS-RMS				
7.5 HKSA 500	500	7.2	1,200	8.25	1.25	6.6	26	75	35,000	40,000	44,000	1.2	44,000	70,000	5
7.5 HKSA 500	500	7.2	2,000	8.25	1.25	6.6	26	75	35,000	40,000	44,000	1.2	44,000	70,000	5
7.5 HKSA 500	500	7.2	3,000	8.25	1.25	6.6	26	75	35,000	40,000	44,000	1.2	44,000	70,000	5
15 HKSA 500	500	13.8	1,200	15.0	1.30	11.5	36	95	19,300	21,000	25,000	1.2	25,000	* 40,000	5
15 HKSA 500	500	13.8	2,000	15.0	1.30	11.5	36	95	19,300	21,000	25,000	1.2	25,000	* 40,000	5
15 HKSA 500	500	13.8	3,000	15.0	1.30	11.5	36	95	19,300	21,000	25,000	1.2	25,000	* 40,000	5
15 HKSA 750	750	13.8	1,200	15.0	1.30	11.5	36	95	28,900	31,500	37,500	1.2	37,500	** 60,000	5
15 HKSA 750	750	13.8	2,000	15.0	1.30	11.5	36	95	28,900	31,500	37,500	1.2	37,500	** 60,000	5
15 HKSA 750	750	13.8	3,000	15.0	1.30	11.5	36	95	28,900	31,500	37,500	1.2	37,500	** 60,000	5
36 HKSA 1,600	1600	34.5	1,200	38.0	1.30	30.0	70	150	25,000	27,500	31,500	1.2	31,500	60,000	5
36 HKSA 1,600	1600	34.5	1,600	38.0	1.30	30.0	70	150	25,000	27,500	31,500	1.2	31,500	60,000	5
36 HKSA 1,600	1600	34.5	2,000	38.0	1.30	30.0	70	150	25,000	27,500	31,500	1.2	31,500	60,000	5

Notes:

† For operating voltages other than those listed, the interrupting Current=Amps at Max. KV $\frac{\text{Max. KV}}{\text{Operating KV}}$ but in no case can this current exceed the interrupting Current at Minimum KV.

* Also available at 60KA

** Also available at 77KA

○ Rating factor is based on breaker speed from initiation to contact parting with 1/2 cycle relay time. Multiply factor X symmetrical current to obtain a symmetrical current interrupting capability of breaker.

△ These values apply with circuit breaker in or out of switch board.

Table 2
25HKSA - Sulphur hexafluoride (SF-6) power circuit breakers - Ratings per IEC

Type of Breaker	Δ Rated Continuous Current 60 Hertz AMPS-RMS	Insulation Level Rated Withstand		Symmetrical Breaking Capacity AMPS-RMS	Interrupting Ratings at Various Voltages				Short Time Rating 3 Sec AMPS-RMS	Making Capacity AMPS-PEAK	Interrupting Time Cycles
		Low Frequency KV-RMS	Impulse Δ 1.2x50MS KV Crest		Three Phase		MVA				
					23 kV	25 kV	27.6 kV	30 kV			
25 HKSA 1000	1200	60	150	25,000	1,000	1,100	1,200	1,300	25,000	63,000	5
25 HKSA 1000	1600	60	150	25,000	1,000	1,100	1,200	1,300	25,000	63,000	5
25 HKSA 1000	2000	60	150	25,000	1,000	1,100	1,200	1,300	25,000	63,000	5
25 HKSA 1000	2500	60	125	25,000	1,000	1,100	1,200	1,300	25,000	63,000	5

Notes: △ These values apply with circuit breaker in or out of switchboard

Type 25 HKSA circuit breakers are tested per IEC

Similar ratings or higher (including 13.8 KV 1000 MVA, 1200A to 4000A) are available with vacuum circuit breakers type HKVA.



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