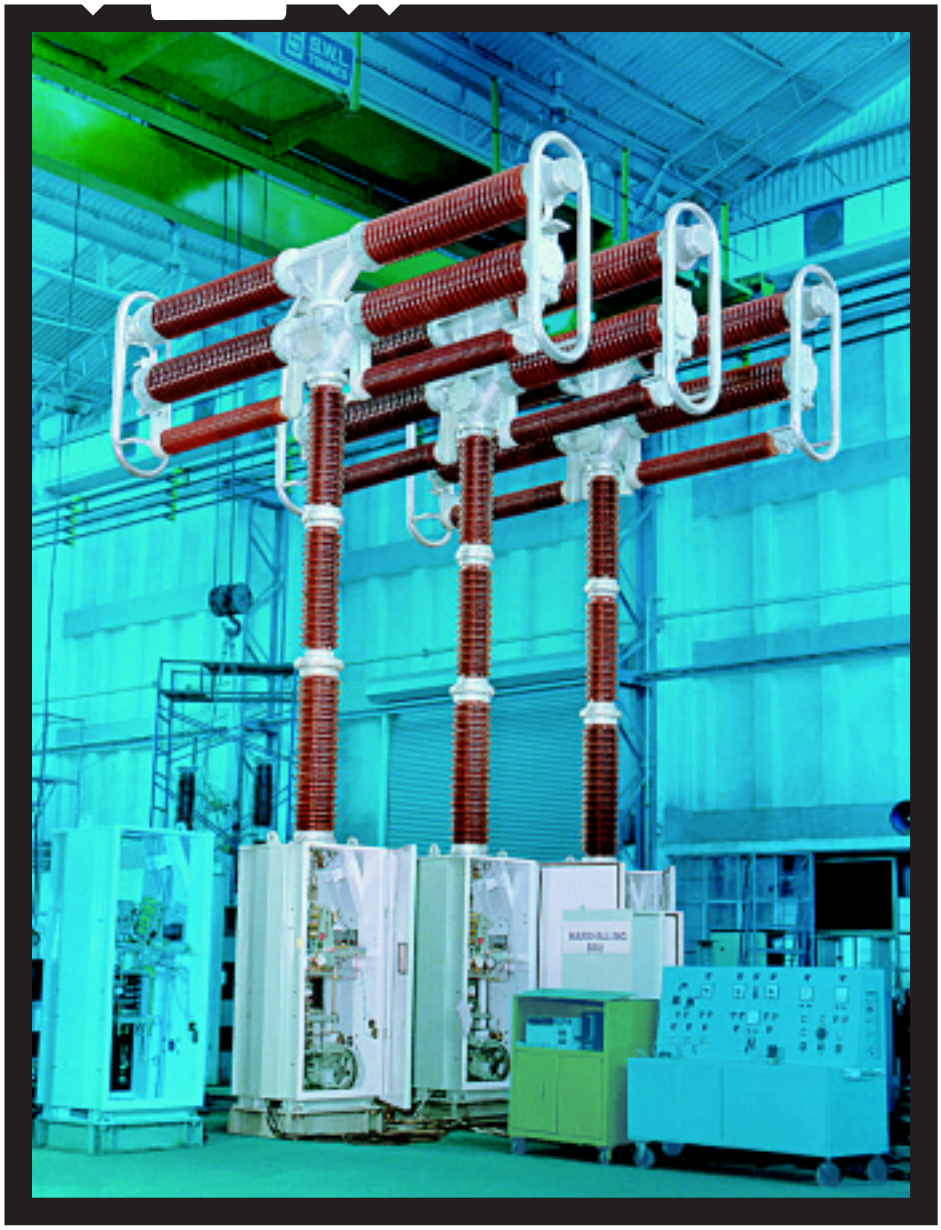
TECHNOLOGY TO THE FORE

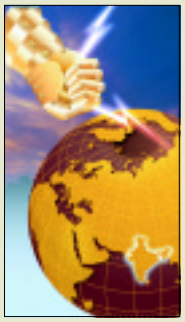
SWITCHGEAR
COMPLEX

SF_6-GAS CIRCUIT BREAKERS
FOR OUT-DOOR USE (72.5 kV TO 420 kV)



Crompton Greaves

TECHNOLOGY TO THE FORE



SWITCHGEAR
COMPLEX

INTRODUCTION

Crompton Greaves Ltd. is one of the leading manufacturers of SF6 Gas Circuit Breakers in the world having a range extending from 6.6 kV to 420 kV.

More than 9000 Crompton Greaves SF6 Gas Circuit Breakers upto 420 kV for outdoor application have been put into service in various environments in many countries since 1983 where they are operating satisfactorily.

Our manufacturing and quality systems adhere to the requirements of the quality standards and scope of ISO 9001.

TYPE SFM GAS CIRCUIT BREAKERS (72.5 KV TO 420 KV)

CG make type SFM breakers are designed to cope with all possible switching phenomenon. The severe rate of rise of the recovery voltage by a short line fault and the high recovery voltage peak by out of phase switching are both cleared by the efficiently designed interrupter using dual flow puffer concept. Small current interruption such as capacitor bank switching, transformer magnetising current breaking, cable/line charging current switching are interrupted smoothly without any re-strikes or re-ignition and the over-voltages observed are minimum.

FEATURES

- Simple and compact design.
- Line to ground clearances as per customer specification.
- Self aligning contacts for easy re-assembly.
- Inspection / maintenance of pole unit possible without dismantling the breaker.
- Separate main and arcing contacts thus eliminating the possibility of erosion of the main contacts.
- Single break upto 245 kV level.
- Consistent operating characteristics as the closing spring is in relaxed condition.
- Stainless steel latches / catches for high reliability.
- Corrosion resistant materials for construction.
- Maintenance free operation of the pole unit for 15-20 years under normal conditions.
- Easy erection.
- No site adjustments.
- Easy access to all parts of operating mechanism through front / back opening panels.
- Low operating noise levels.
- Auto drain valve for unmanned substation operations.
- Pressure relief device.
- High seismic withstand capability - earthquake safety.
- Complete range tested at CESI, Italy or KEMA, Netherlands.

CONSTRUCTION & OPERATION

All our SF6 Circuit breakers have a similar interrupter design. The range of breakers from 72.5 kV to 245 kV are manufactured with single break interrupter design while 420 kV breakers are manufactured with double break interrupters. These breakers are of live tank design and employ puffer action for interruption ensuring higher operational reliability and safety of power transmission and distribution systems.

Fig. 1 shows the sectional view of the single phase-single break type breaker while Fig. 2 shows the same for three phase-single break type breaker. The interrupting unit filled with SF6 Gas is placed at the top of the pole and contains Stationary Contact, Nozzle, Moving Contact, Puffer Cylinder and Fixed Piston. During opening operation the Moving Contact alongwith the Puffer Cylinder is pulled down. The Puffer Cylinder, which moves alongwith the Moving Contact, compresses the SF6 Gas against the Fixed Piston thus generating a powerful SF6 Gas blast through the Nozzle and over the arc. After travelling through some distance, the dielectric strength of the gap is sufficient to withstand the voltage and thus the arc extinguishes. The reliability of the system is further increased by the single pressure dual flow SF6 Gas puffer interrupter which reduces the number of moving parts and auxiliary systems in the circuit breaker. This simple principle is shown in Fig. 1(a).

FIG. 1

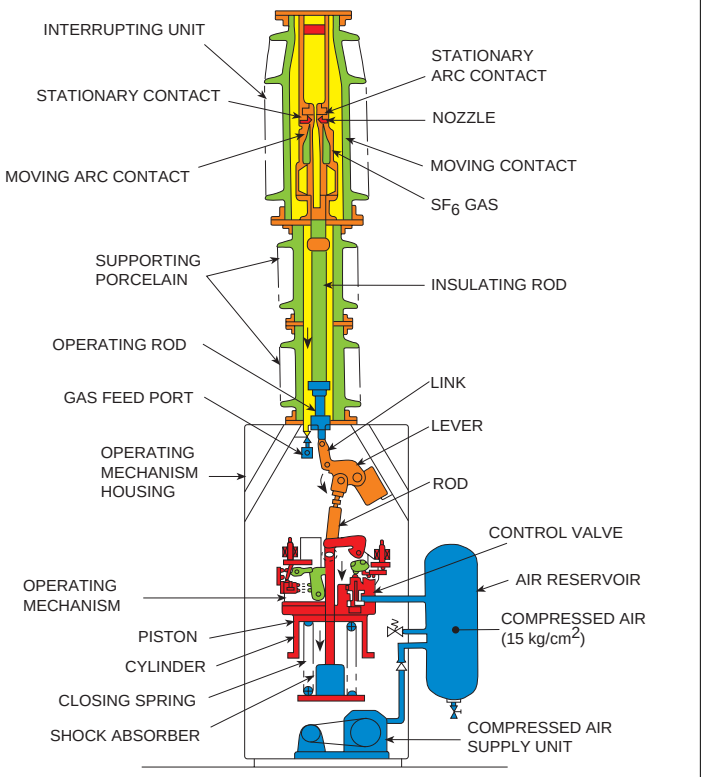
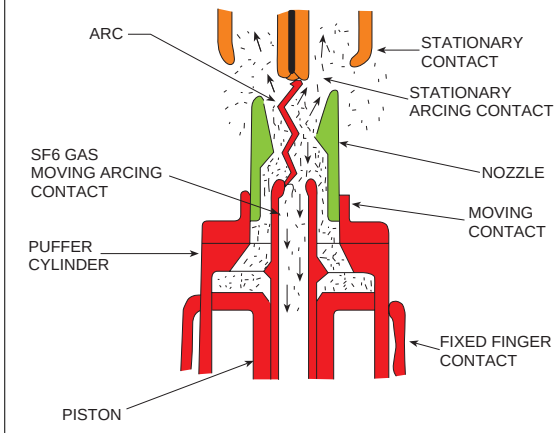
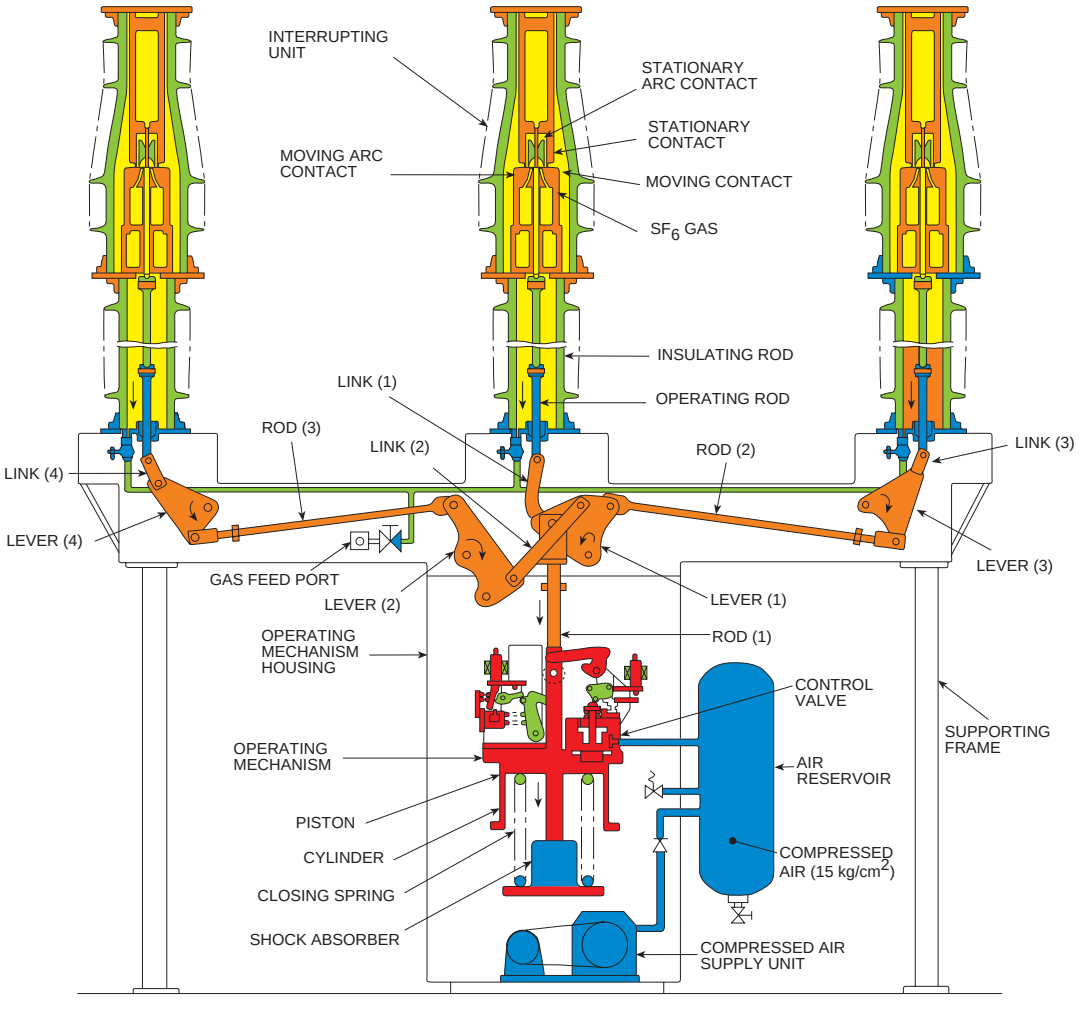


FIG. 1(a)



INTERRUPTING PRINCIPLE

FIG. 2

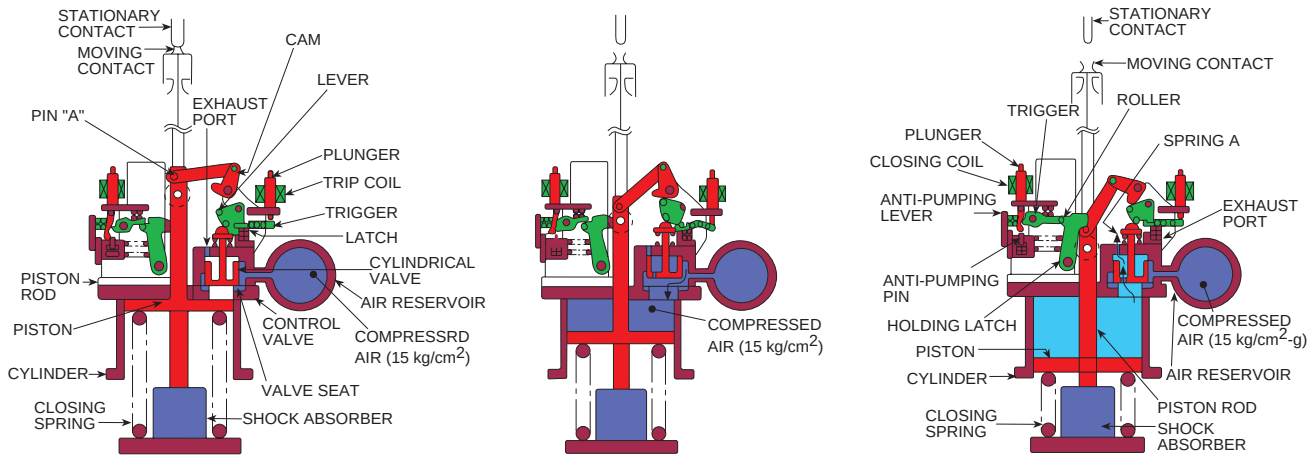


SPRING - PNEUMATIC OPERATING MECHANISM

The operating mechanism is of spring-pneumatic type wherein the tripping operation is done by pneumatic energy and closing operation is done by spring energy without a spring charging motor (Fig.3). This is very different from the conventional pneumatic mechanisms which use pneumatic energy for both tripping and closing operations. During tripping operation, the pneumatic energy is supplied by an air reservoir which is fitted on the mechanism housing. An air compressor housed in the mechanism housing maintains the air pressure in the air reservoir at the operating pressure of 15 kg/cm2. At the end of tripping operation the closing spring gets charged automatically. Each breaker is fitted with its own independent compressor thus avoiding the elaborate piping and compressed air system required for central compressor design. The breakers can be transported and commissioned anywhere without any infra-structural implications. An added advantage of this type of mechanism is that since pneumatic energy is involved only during tripping operation, the entire pneumatic system works on one single pressure and one reservoir, thereby increasing the compactness and reliability of the breaker.

In the single phase autoreclosing type, one operating mechanism per phase is provided in all the breakers. All three poles and associated operating mechanisms are interconnected electro-pneumatically to ensure simultaneous and reliable operation of all the three phases. In the three phase autroreclosing type (gang type operating mechanism) - available in 72.5 kV, 145 kV and 170 kV ratings - a single operating system drives all the three interrupting units.

FIG. 3



AIR AND GAS SYSTEM

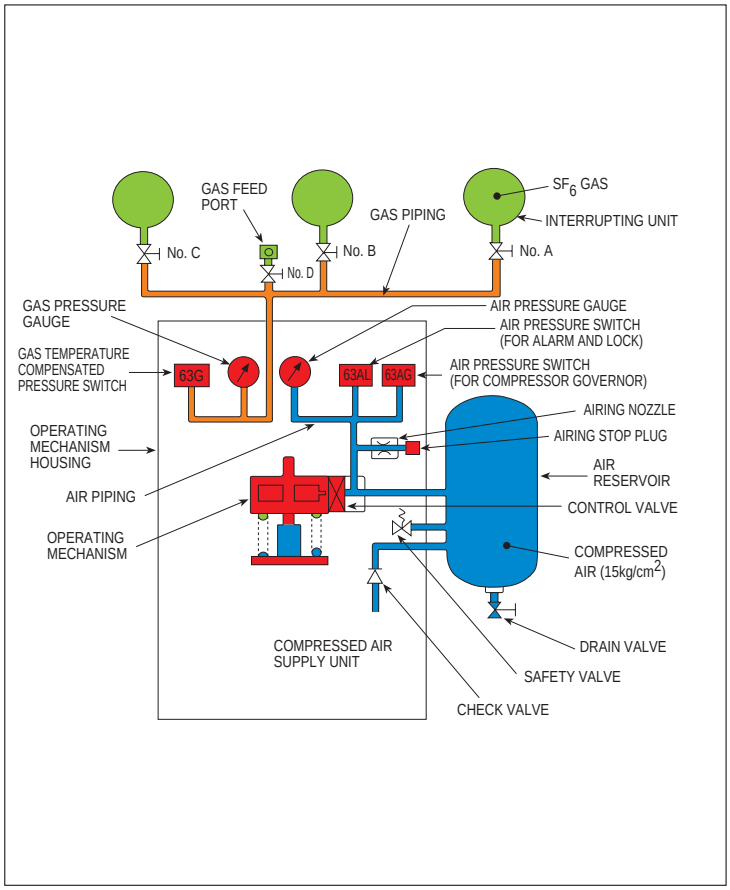
Gas System (Refer Fig. 4)

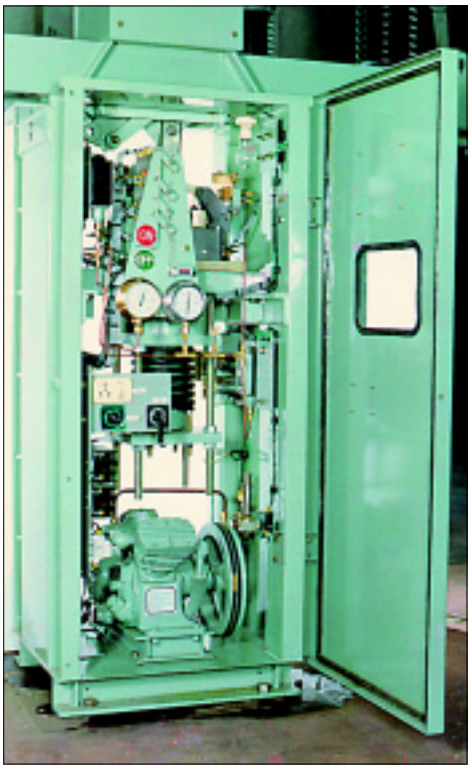
- Three interrupting units connected by gas piping have gas valves A, B and C individually.
- Gas piping is connected to gas pressure gauge, temperature compensated gas pressure switch and gas feed port.
- Gas valves A, B and C should be normally open.
- Gas valves D should be normally closed.
- Density of SF6 Gas is monitored by gas temperature compensated pressure switch.
- Filling of SF6 gas is possible from gas feed port by opening gas valve D even in energized condition.

Air System (Refer Fig. 4)

- The operating mechanism is connected to control valve, air reservoir, air pressure gauge, air pressure switches, airing nozzle and airing stop plug by air piping.
- Air reservoir is connected to compressed air supply unit through check valve.
- Safety valve is connected to air reservoir with drain valve.
- Compressed air generated by compressed air supply unit is led to air reservoir and control valve through check valve.
- Check valve prevents compressed air inside air reservoir from returning to compressed air supply unit.
- Moisture inside air reservoir is periodically drained through the presettable timer actuated automatic drain valve (optional).

FIG. 4





ROUTINE TESTING

All routine tests as specified in IEC 56 are conducted on the fully assembled breakers at our factory. In addition to the specified tests as per IEC, the following additional tests are done on each breaker.

1) Gas leakage test.
2) Air leakage test.
3) Speed and timing test.
4) Pneumatic system test.
5) Air & Gas pressure switches test.

CGL testing laboratory is fully equipped with the latest testing equipment like

1) 600 kV Test Transformer - Programmable Logic Control MUR 24A.
2) High precision mass spectometer type leak detector (with capability todetect leaks as low as 1 ppm).
3) Multichannel breaker Speed / Time analysers.
4) Millivolt drop test set.
5) Primary injection test set.

Typically, a fully assembled breaker is tested in 4 hours. Full testing before despatch of breaker ensures trouble free operation at site and complete customer satisfaction.

QUALITY & SURFACE TREATMENT

All critical components and sheet metal stampings are manufactured on precision CNC machines ensuring high dimensional consistency. All parts coming in contact with moisture are zinc/cobalt black passivated. All exposed ferrous parts are treated to give high corrosion resistance. They are shot blasted, spray galvanised, primer coated and finally painted with polyurethane based paint or Epoxy paint ensuring excellent finish and protection. All joints are secured against loosening by using torque wrenches and other suitable means.

TRANSPORT & SITE INSTALLATION:

All the Circuit Breakers are factory tested and then depending on the type involved are partly dismantled into packing units which are then despatched. All the sub assemblies are individually wrapped to reduce the harmful effects of atmospheric air. For Exports the breakers are despatched in seaworthy packing. The Circuit Breaker poles are filled with a small quantity of SF6 Gas (at a pressure of 0.5 kg/cm2) for transportation to avoid moisture ingress and site evacuation. Site installation is simple and no site adjustments are required during erection and comissioning, all main adjustments are done in the factory prior to delivery.

CUSTOMER SUPPORT AND AFTER SALE SERVICE:

We provide solutions to all possible customer technical requirements through our highly qualified engineers having rich experience in the field.

Our service engineers and technicians and authorised representatives can provide supervision of erection and comissioning and after sales service at site.

GUARANTEED TECHNICAL PARTICULARS
72.5 - 420 kV SF6 GAS CIRCUIT BREAKER (SPRING - PNEUMATIC MECHANISM)

		UNITS	72.5 kV	123 kV	145 kV	145 kV	170 kV	245 kV	420 kV
1. TYPE REFERENCE	:	-	70-SFM-32A	120-SFM-32A	120-SFM-32A	120-SFM-40A	150-SFM-32A	200-SFM-40A	400-SFM-40A
2. RATED VOLTAGE	:	kV	72.5	123	145	145	170	245	420
3. RATED LIGHTNING IMPULSE WITHSTAND	:	kVp	325	550	650	650	750	1050	1425
4. RATED POWER FREQUENCY WITHSTAND	:	kV	160	230	275	275	325	460	520 / 610
5. CREEPAGE DISTANCE (TOTAL)	:	mm	1820	3075	3625	3625	4250	6125	10500
6. APPLICABLE STANDARDS	:	-	IEC 56, BSS 5311 & JEC 181						
7. TYPE OF MECHANISM	:	-	SPRING - PNEUMATIC						
8. RATED NORMAL CURRENT	:	A	3150						
9. RATED OPERATING SEQUENCE	:	-	O-0.3 sec-CO-3 min-CO						
10. RATED FREQUENCY	:	Hz	50/60						
11. RATED DURATION OF SHORT CIRCUIT	:	sec.	3						
12. RATED CLOSING / TRIPPING VOLTAGE	:	V	110/220 V DC						220 V DC
13. CURRENT OF CLOSING /OPENING COIL	:	A	6 A max. at 110 V DC						3 A max. at 220 V DC
14. RATED BREAK TIME	:	ms	60						40
15. RATED CLOSING TIME	:	ms	100			120		100	150
16. RATED SHORT CIRCUIT BREAKING CURRENT	:	kA	31.5			40	31.5	40	
17. RATED SHORT CIRCUIT MAKING CURRENT	:	kAp	80			100	80	100	
18. RATED LINE CHARGING BREAKING CURRENT AND OVER VOLTAGE	:	A / pu	10 / <2.5	50 / <2.5			63 / <2.5	125 / <2.1	600 / <2.0
19. RATED CABLE CHARGING BREAKING CURREN AND OVER VOLTAGE.	:	A / pu	250 / <2.5	160 / <2.5			315 / <2.5	400 / <2.0	*
20. RATED SINGLE CAPACITOR BANK BREAKING CURRENT AND OVER VOLTAGE.	:	A / pu	250 / <2.5	300 / <2.5		160 /<2.5	315 / <2.5	400 / <2.0	*
21. RATED OUT OF PHASE BREAKING CURRENT	:	kA	7.9			10	7.9	10	
22. FIRST POLE TO CLEAR FACTOR	:	-	1.5					1.3	
23. AUXILLIARY CONTACTS	:	-	9 NO + 9 NC8 NO + 8 NC / POLE						
24. SF6 GAS PRESSURE (AT 20° C)									
- NORMAL	:	Kg/cm2	5.0	6.0		6.0	7.0	6.0	
- GAS FEED ALARM	:	Kg/cm2	4.5	5.5		5.5	6.5	5.5	
- LOCKOUT	:	Kg/cm2	4.0	5.0		5.0	6.0	5.0	
25. DIMENSIONS									
A	:	mm	1400	1700/2000	1700/2000	2000	2000	4600	6000
B	:	mm	3065	3365	4003	4003	4003	4605	—
H (WITHOUT CLOSING RESISTOR)	:	mm	4118	4738	5376	5376	5536	6965	8360*
H (WITH CLOSING RESISTOR)	:	mm	—	—	—	—	—	—	8760*
26. WEIGHT									
(WITHOUT CLOSING REISTOR)	:	kg	1650	2000	2000	2200	2000	3900	7950
(WITH CLOSING RESISTOR)	:	kg	—	—	—	—	—	—	9600

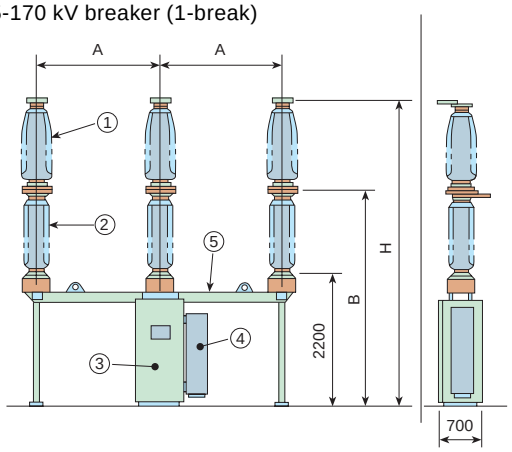
* WITH SUPPORT STRUCTURE

OPTIONALS

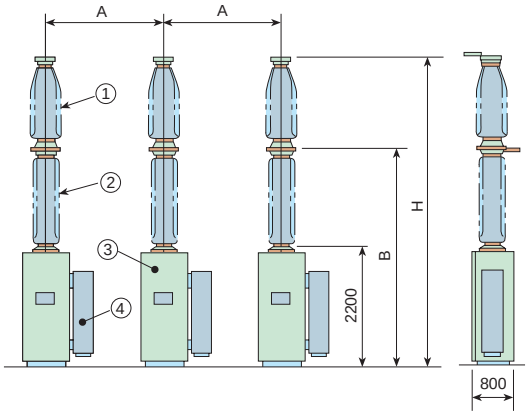
	UNITS	72.5 kV	123 kV	145 kV	145 kV	170 kV	245 kV	420 kV
1. CREEPAGE DISTANCE	mm / kV	25	25,31,35, 40,45	25,31,35, 40,45	25,31,35	25,31,38	25,31,37	25
2. CLOSING / TRIPPING COIL VOLTAGE	V (DC)	110/125/220						
3. PRESSURE RELIEF DEVICE & AUTO DRAIN VALVE FOR AIR RESERVOIR	-	CAN BE PROVIDED						
4. CLEARANCE OF LIVE PARTS TO GROUND	-	AS PER CUSTOMER SPECIFICATIONS						
5. MAX. ALTITUDE ABOVE SEA LEVEL	m	1700	2500	2500	1000		2400	1000
6. AUXILLIARY CONTACTS	-	15 NO5 & 15 NC					15 NO + 15 NC / POLE	
7. SEISMIC ACCELERATION	g	0.3/0.5						0.3

Dimensional Details

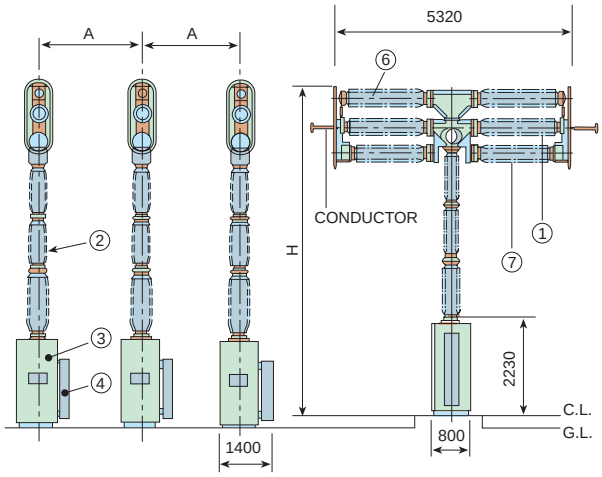
72.5-170 kV breaker (1-break)



245 kV breaker (1-break)



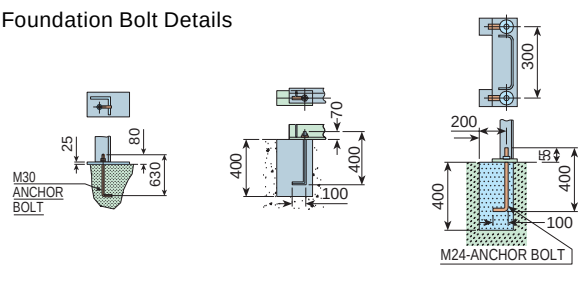
420 kV breaker (2-break)



KEY

1. Interrupter
2. Supporting Porcelain
3. Operating Mechanism Housing
4. Air Reservoir
5. Frame (For Gang Operated Breakers)
6. Closing Resistor (420 kV Breaker)
7. Grading Capacitor (420 kV Breaker)

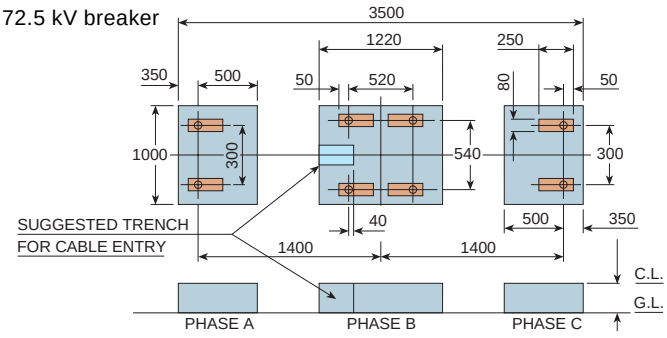
Foundation Bolt Details



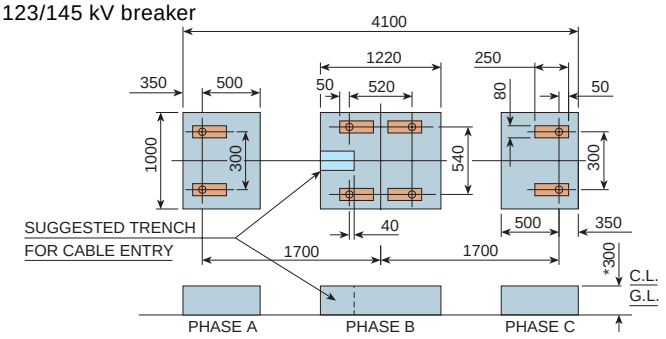
420 kV | 245 kV | 72.5 to 170 kV

Foundation Plan Details

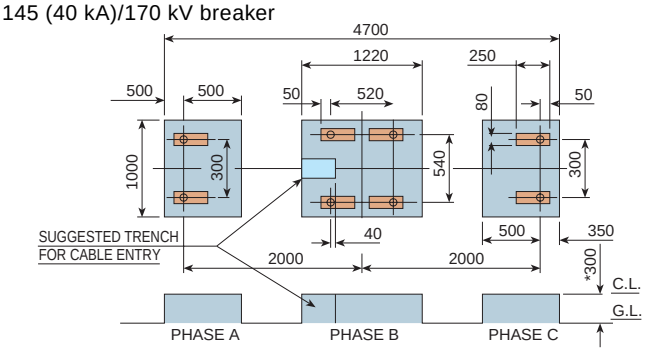
72.5 kV breaker



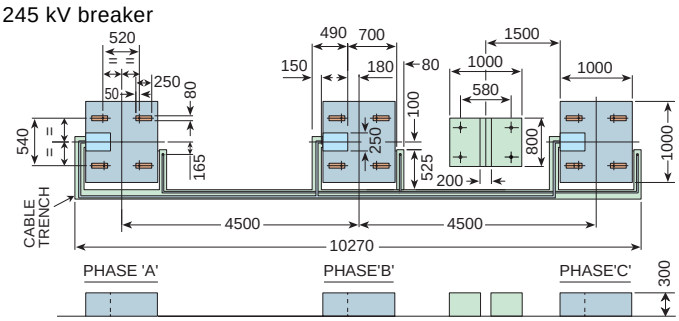
123/145 kV breaker



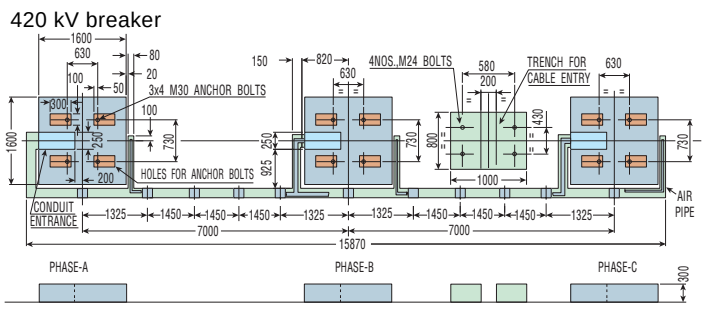
145 (40 kA)/170 kV breaker



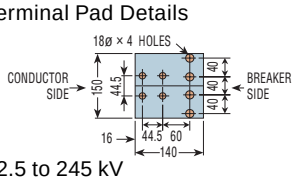
245 kV breaker



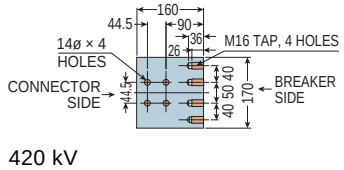
420 kV breaker



Terminal Pad Details



72.5 to 245 kV



420 kV

Power Systems
A Business Unit of Crompton Greaves Ltd.

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Crompton Greaves
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The Thapar Group

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