

Westinghouse



**Single Tank
Outdoor Oil Breaker
Type GS**



Application

For 14.4 through 69 kv power transmission systems, 20 cycle reclosing.

Type GS breakers combine high interruption capabilities, short arcing time and high-speed reclosing with single tank construction to provide excellent reliability, fast fault-clearing and easy maintenance.

Advantages

The single tank construction holds space requirements to a minimum, offers a significant reduction in oil requirements and reduces foundation loading requirements.

Single tank construction offers measurable reduction in maintenance cost. Lowering single tank offers access to all interrupters. Simplified mechanism linkage permits easy access to entire mechanical train.

Use of AA-7 mechanism offers high speed reclosing with the reliability of a time proven design.

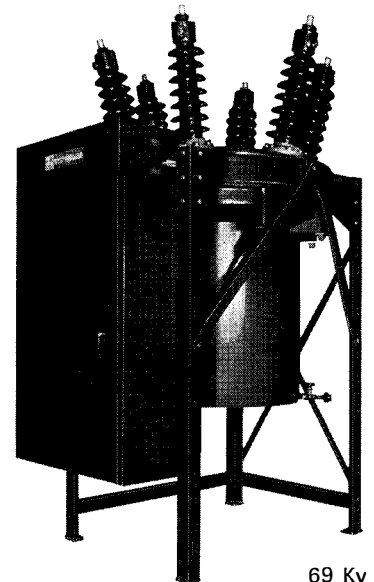
De-ion® grid construction insures high interrupting capacity with short arcing time and will permit high speed reclosing.

Standard Ratings

Rated Voltage Kv	Continuous Current Rating Amperes	Interrupting Capacity 3 Phase Mva
14.4	1200	1000
23	1200	1500
34.5	1200	1500
46	1200	1500
46	1200	2500
69	1200	2500
69	1200	3500

Interrupting Time

14.4 through 69 Kv.....5 cycles

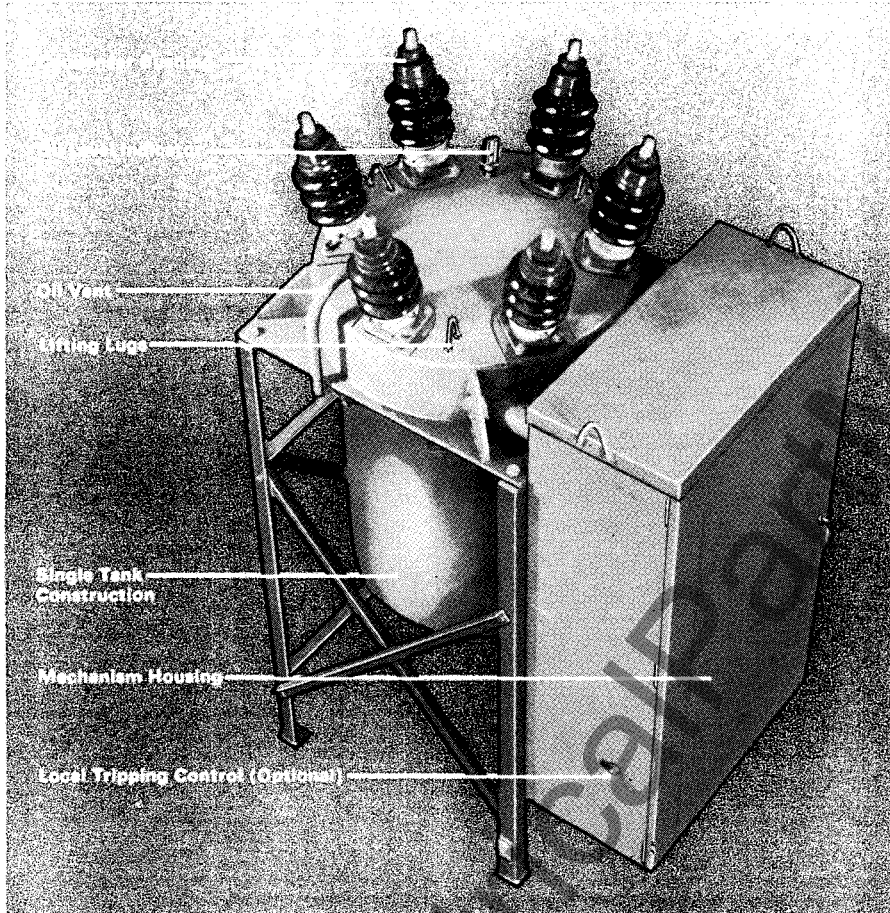


69 Kv

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General Description



The type GS oil circuit breaker consists of a single tank bolted to a frame mounted steel dome. Mounted on the tank dome are six condenser type bushings, bushing current transformers, and the breaker linkage system for all three phases.

Lifting eyes and an oil level indicator are the only obstructions on the smooth deep drawn elliptical tank top. The smooth surface on the dome eliminates many of the irregular and inaccessible surfaces that make painting and cleaning the top a difficult task.

The single tank construction also eliminates all interpole conduit, condulets or troughs for current transformer leads, holds space requirements to a minimum, offers a significant reduction in oil requirements, and reduces foundation loading requirements. For example, at 34.5 kv, the single tank breaker requires 46% less ground space, 22% less oil, and 24% less foundation loading when compared with existing three tank designs.

Condenser Bushings

The Type IC condenser bushings rated 1200 amperes, 23 kv through 69 kv are manufactured to ANSI standard dimensions. They are interchangeable with transformer bushings of the same current and voltage rating, and with bushings of same rating of other manufacturers built to ANSI standard dimensions. The time-proven condenser principle distributes voltage stress evenly through and across the insulation — resulting in a compact design with high cantilever strength and no “weak links” to invite voltage breakdown. Bushings have low power factor and have radio influence level below established standards.

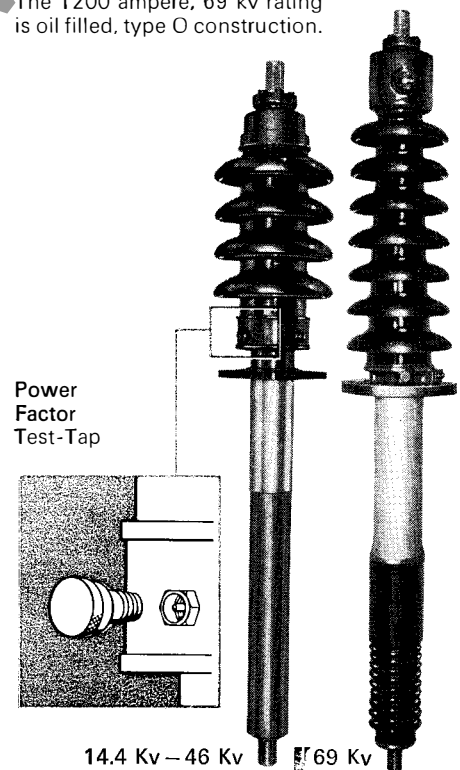
For ratings through 46 kv the entrance conductor is a hollow copper stud threaded for terminal connection. Insulating layers of treated paper are wound around the stud under heat and pressure. Treating compound in the paper binds them into a homogeneous insulation.

Interspersed at regular intervals between

the paper layers are sheets of metal foil, which form condenser plates. This series of condensers distributes the voltage stress evenly through and across the insulation.

A single-piece porcelain weather casing surrounds the condenser. The porcelain is flexibly supported at the base by a copper diaphragm and at the top is a flexible copper cap, to compensate for expansion and contraction differentials. Solder-seal joining of porcelain to copper ring and caps forms a hermetically-sealed, moisture-tight housing without gaskets. The space between the porcelain and condenser is filled with a plastic compound which retains its plastic and adhesive properties over the temperature range of breaker operation.

The 1200 ampere, 69 kv rating is oil filled, type O construction.

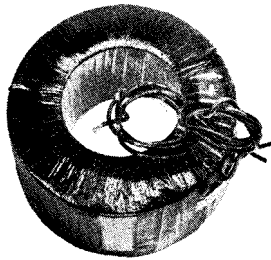


Power Factor Test-Tap

Accurate power factor testing of the complete bushing, in place, is simplified by an ungrounded test-tap. The power factor tap is grounded to the bushing flange while the breaker is in service. For testing, the ground is removed. The power factor of the insulation, only, can then be measured, by using an ungrounded test set. This eliminates extraneous effects of oil, De-ion grids, or parallel insulation of incoming lines.

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Current Transformers



Current transformers are mounted on the bushings within the tank. The current transformers are designated Type BYM, Hypersill Steel Core, multi-ratio for relaying purposes.

The leads of the current transformers are brought through the tank top to the mechanism house where they are connected to terminal blocks.

The transformer leads are brought out of the tank dome through a pressure seal which is composed of a neoprene bushing compressed between two moldarta blocks. This type pressure seal eliminates the requirements for pouring of gum.

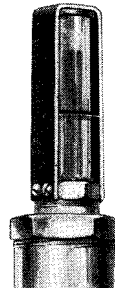
Improved current transformer mounting makes it possible to mount two standard accuracy current transformers per bushing. This new type of mounting also makes it possible to add a second transformer without disturbing the mounting of the original transformer.

Metering accuracy current transformers are available at request.

The current transformers meet all ANSI and NEMA requirements for relaying and indicating instrument application.

ANSI metering accuracy single ratio current transformers can be supplied in place of or in addition to relaying transformers. Linear couplers can be supplied for this differential protection.

Float-type Oil Gauge



A float-type oil gauge is mounted on top of the tank. Since it is above the oil level, leakage and loss of oil through breakage of glass is eliminated. Fire hazard from oil leaking from broken glass is removed.

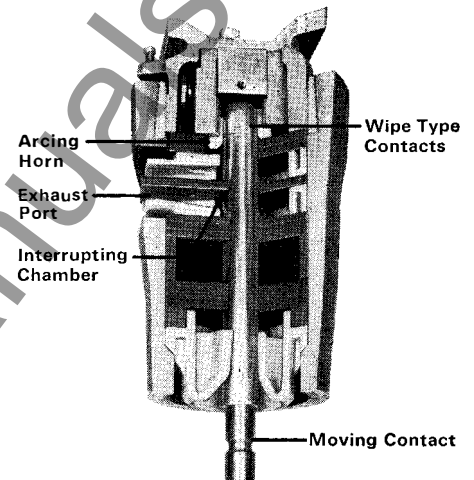
Exhaust Vent, Oil Baffle

An exhaust vent and oil baffle are mounted in the tank dome to permit pressures during interruption to be vented from the tank dome without permitting oil discharge.

Optional Tank Lifter

For raising and lowering the single tank a pneumatic tank lifter is available.

Interrupter



The Westinghouse Type GS breakers feature a newly designed interrupter series, designated as Type SB, which utilizes a De-ion grid control. The interrupter featured above is the SB-1 and is used on GS breakers rated 14.4 through 34.5 kv. The 46 through 69 kv Type GS uses the SB-2 interrupter which is similar to the SB-1 while incorporating voltage dividing resistors.

The interrupter employs a glass filament wound interrupter chamber and wide use of molded plastic interrupter parts. The use of non-hygroscopic material prevents dimensional changes as the interrupter ages.

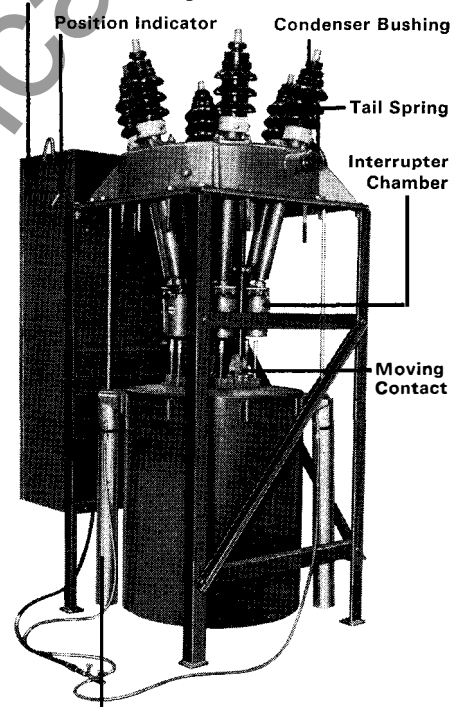
Exhaust vents on the interrupter are positioned radially to prevent any reduction in interphase dielectric strength during switching operations.

The interrupter's performance has been verified through intensive testing in the High Power Laboratory and will meet all applicable NEMA and ANSI standards.

The interrupter construction in addition to offering high capacity performance offers the following additional advantages to the user:

1. Liberal use of silver tungsten, a material noted for its successful resistance to arcing, on all contact surfaces exposed to arcing extends the useful life of the contacts and reduces the total maintenance required.
2. Wipe type construction clears contact surfaces during each breaker operation preventing buildup of carbon deposits in the breaker's current path.
3. Interrupter chamber and grid construction has been simplified to permit their quick removal for contact inspection without affecting contact adjustment.

Mechanism Housing



Pneumatic Tank Lifter

Westinghouse



Arc Extinction

As the contacts open, nearby oil flashes into ionized gas to conduct a heavy arc between the stationary and moving parts. The arc terminals quickly move to stationary arc horn and moving contact arc tip which protects contact surfaces from burning.

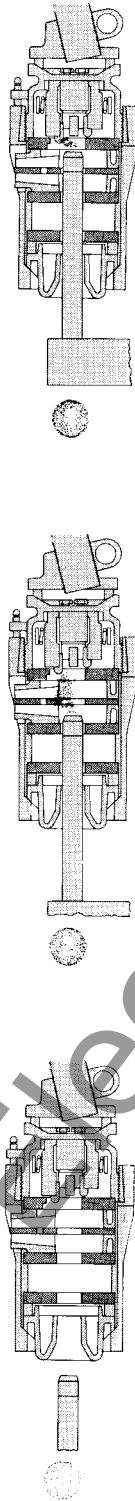
The top section interrupts high current arcs with a minimum of arc length and energy. It is composed of oil pockets, vent plates and a splitter plate. When a high current arc is drawn pressure builds up quickly in this section.

The gases formed are vented through the channel provided. Flow of gas into these channels forces the arc to move into the direction of the flow. The arc is drawn, de-ionized and extinguished in a period of one to two cycles.

The remainder of the chamber is composed of another chamber which serves to interrupt in middle or low range current.

During low current interruption, relatively little pressure is generated. The action of the top section is reduced but as the arc is lengthened, it is continuously exposed to new supplies of fresh oil. The arc is lengthened and cooled, causing rapid de-ionization and interruption.

After the arc has been completely extinguished and contacts are fully open, fresh oil replaces gas in grids.



Mechanical Operation

Energy for opening is stored in the tail spring located in the tank dome and a spring at the base of the AA-7 piston permitting the breaker to be tripped with a low energy signal.

When tripped, the springs transmit their energy to a single horizontal linkage located in the tank dome to a lever above each pair of interrupters which transfers the motion to the vertical pull rods and moving contacts.

During the opening stroke, a shock absorber is picked up during the last few inches of contact travel to cushion shock and prevent bouncing without sacrificing speed. The shock absorber will also limit the speed of the moving contacts to insure the most efficient performance of the interrupter.

To close the breaker, a low energy signal actuates an air valve on the AA-7 pneumatic mechanism. High pressure air stored in the reservoir operates against a piston. The closing force is transmitted to a vertical pull rod in the mechanism house, through a bell crank to the horizontal linkage which charges the tail spring and draws the moving contacts to the closed position.

On closing, the insulating guides and molded plastic bevels at the interrupter orifice guide the moving contacts smoothly to the closed position.

Lift rods and guides are high-strength nonconducting and oil resistant – with mechanical strength to withstand impact shock.

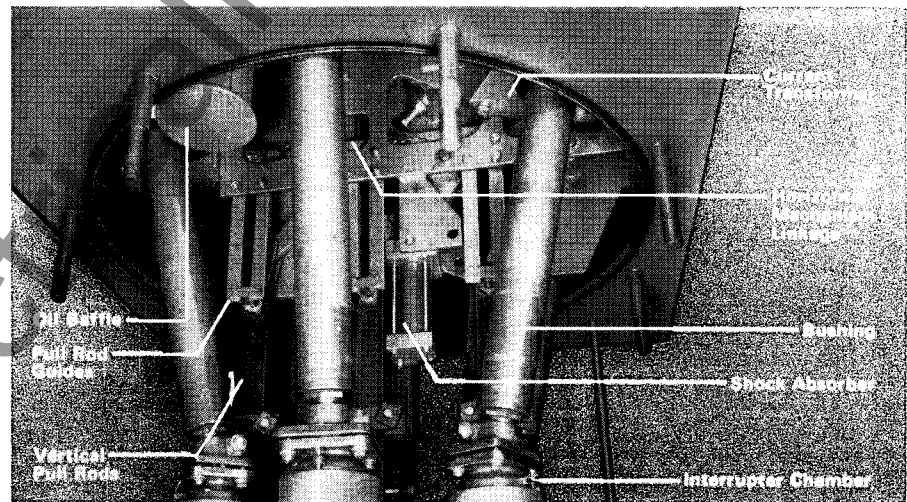
All mechanical parts are preadjusted and tested at the factory to minimize the time required to put the breaker in service. All levers, links and pins are easily accessible.

Provision for Cincinnati timer is available.

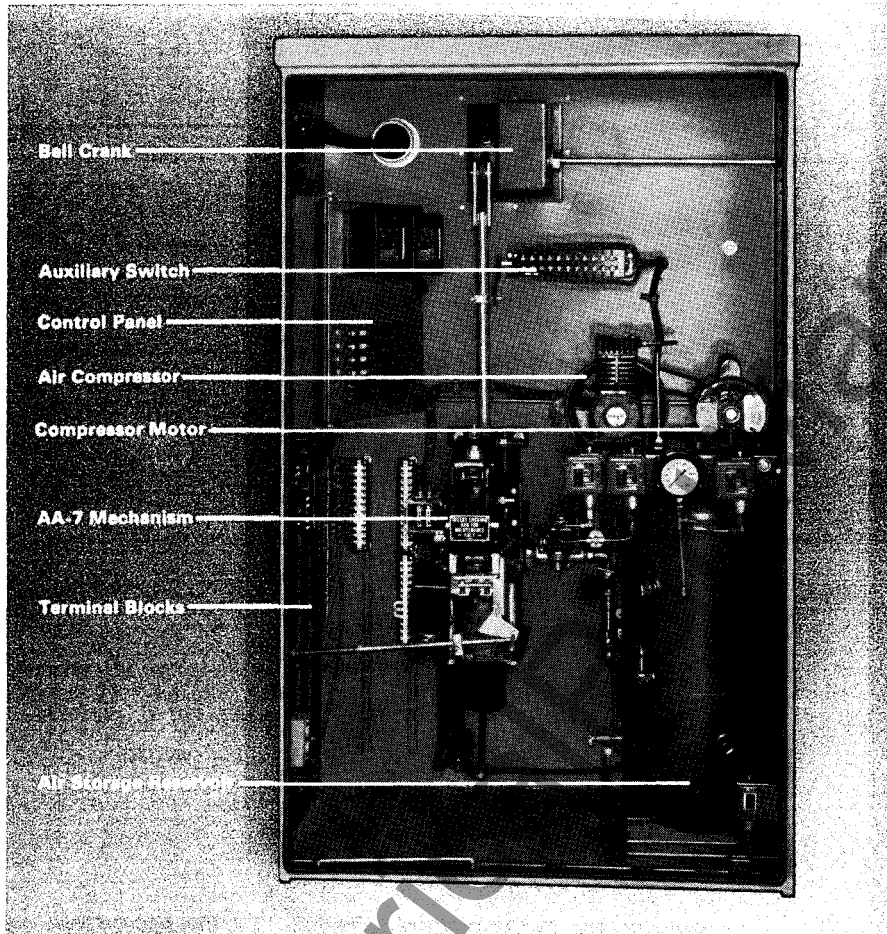
A position indicator, mounted externally on its mechanism cabinet, is connected to the mechanical linkage to provide a positive visual indication of the breaker's position.

Shock Absorber

A shock absorber is used to limit the speed of the moving contacts insuring the most efficient performance of the interrupter and cushioning the shock of the moving contacts when reaching the full open position. The oil used in the shock absorber is drawn from the oil used by the breaker.



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Pneumatic Operating Mechanism

Type AA-7 electropneumatic mechanism is used. This mechanism is mechanically and electrically trip-free.

Each mechanism is complete with its own storage reservoir, motor-driven compressor, pressure relay, pressure gauge, and safety valve to prevent excessive pressures. The reservoir contains sufficient air for five immediate closing operations without operation of the compressor. A drain valve is provided to remove condensed moisture from the reservoir. The air supply system meets all the requirements of the ASME, state and insurance codes.

The weatherproof cabinet has a large access doorway, sealed with rubber gaskets, to provide easy access for inspection and maintenance. A heater element provides continuous inside-outside temperature differential, with additional thermostatically controlled heater for winter use.

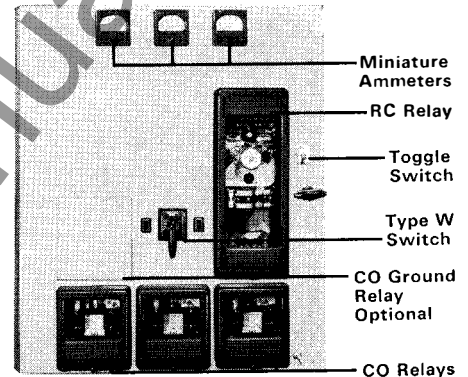
Included in the housing are necessary auxiliary switches, cutoff switch, latch check switch, alarm switch, and operation counter. The control relays and three control knife switches (one each for the control circuit, compressor motor, and heater circuit) are mounted on a hinged panel. Terminal blocks on the side and back of the housing are provided for control and transformer wiring.

The AA-7 is ideally suited for high speed reclosing. Reclosing speeds of 20 cycles (60-cycle basis) from the instant of initial tripping impulse until the current is re-established are common, and faster reclosing speeds have been obtained.

Pneumatic Mechanism With High Speed Reclosing

To restore service automatically after fault clearance, type GS circuit breakers may be equipped with an automatic reclosing

package. Reclosing equipment is mounted on a hinged panel housed in the operating mechanism cabinet. Complete factory assembly, inspection and testing minimizes installation time and expense.



Operation

RC Recloser: The type RC recloser is normally arranged for a total of three reclosures. The first may be immediate or time delay with automatic reset if the breaker stays closed, or lockout if the breaker trips immediately after the third reclosure. After lockout, the breaker will not reclose automatically and hence must be closed manually.

If the breaker is tripped manually by the control switch, a contact in the control switch is opened and the breaker will not reclose automatically. Automatic operation is restored by manually closing breaker through the control switch.

For instantaneous initial tripping followed by delayed subsequent tripping, an integral contact of the RC reclosing relay is used in conjunction with CO relays with instantaneous trip contacts brought out to separate studs.

Other Reclosing Schemes Available

SGR-12 Recloser: Single-shot instantaneous reclosure, automatic reset and lockout if breaker closes after first reclosure.

SGR-1 Recloser: Single-shot instantaneous reclosure with hand reset.

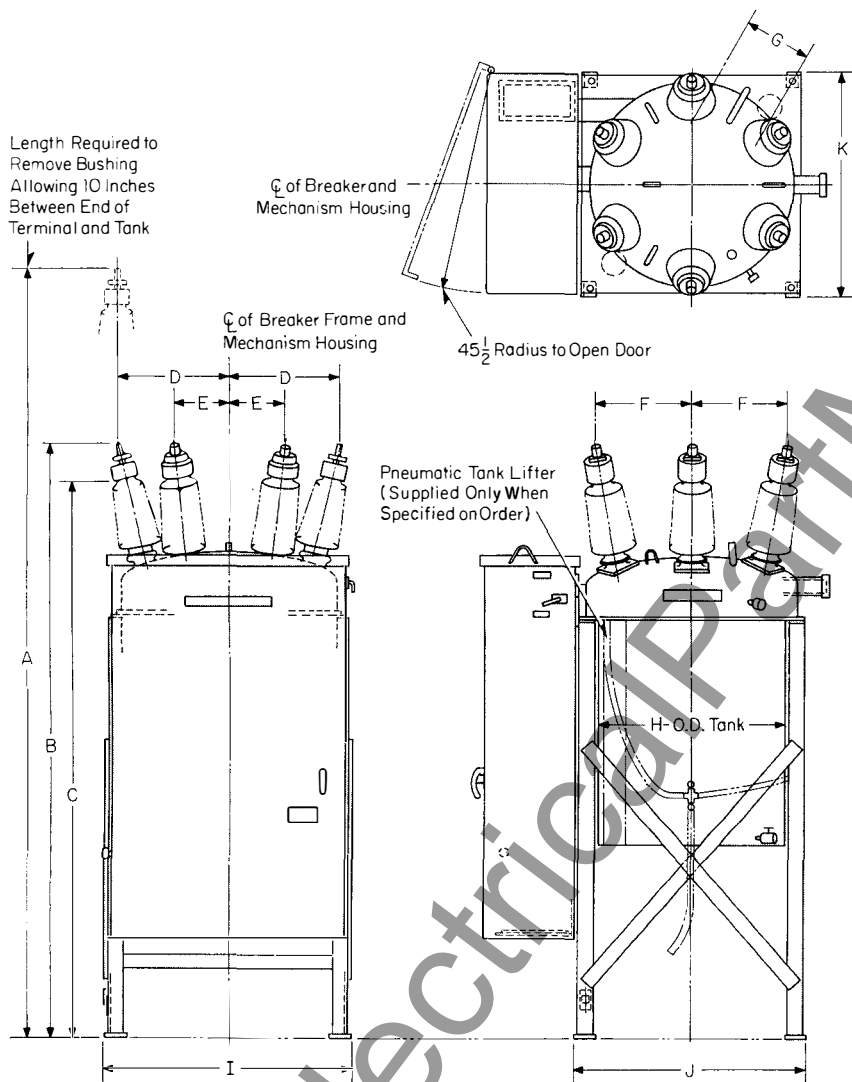
Rating Factor: All ratings are based on the standard duty cycle (CO+15 sec.+CO). For duty cycles other than standard, breakers should be derated in accordance with Technical Data 33-060.

For typical SGR-12 schemes, see "Wiring Diagram", page 7. See "Specification Details", page 8 for complete equipment listing.

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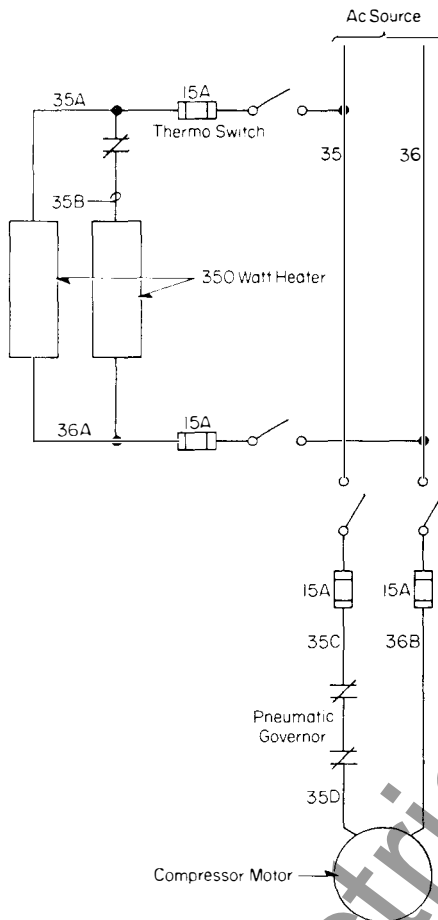
Dimensions in Inches (Not for Construction Purposes)



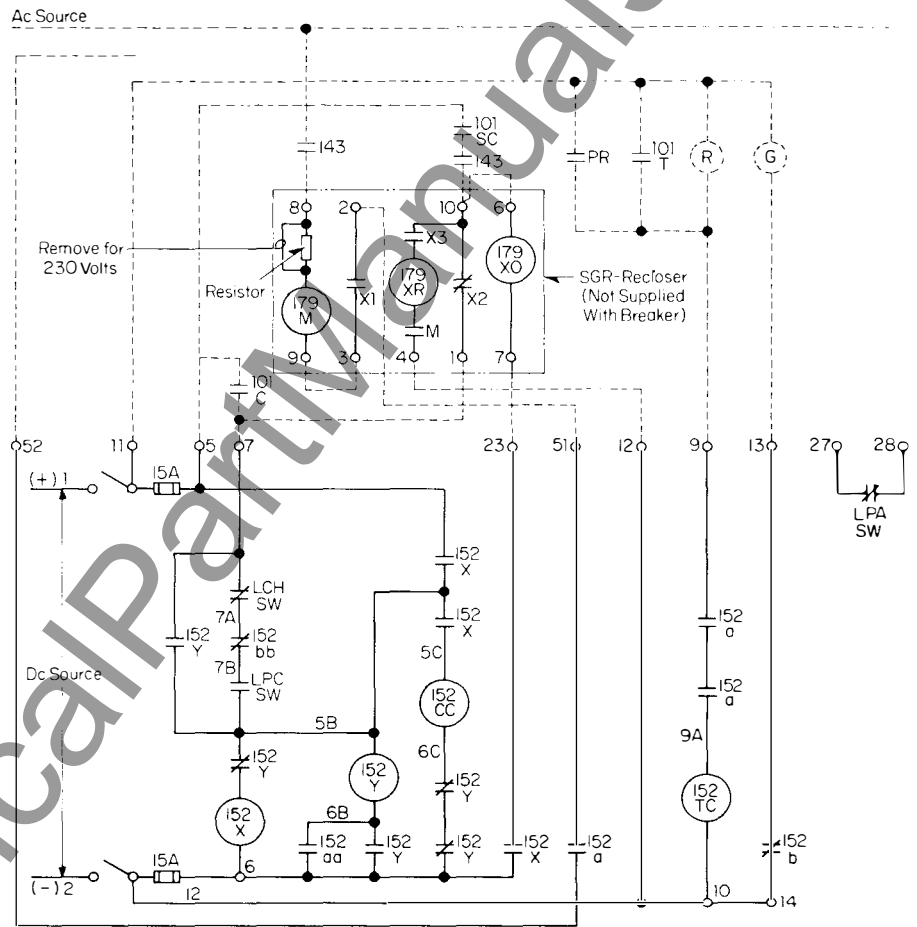
Breaker Type	Kv	Amperes	Mva	Dimensions										
				A	B	C	D	E	F	G	H	I	J	K
144GS1000	14.4	1200	1000	164	123 $\frac{3}{8}$	116 $\frac{1}{8}$	21 $\frac{1}{2}$	10 $\frac{1}{16}$	18 $\frac{1}{2}$	14 $\frac{3}{16}$	38	46 $\frac{3}{4}$	66 $\frac{3}{4}$	46 $\frac{3}{4}$
230GS1500	23.0	1200	1500	164	123 $\frac{3}{8}$	116 $\frac{1}{8}$	21 $\frac{1}{2}$	10 $\frac{1}{16}$	18 $\frac{1}{2}$	14 $\frac{3}{16}$	38	46 $\frac{3}{4}$	66 $\frac{3}{4}$	46 $\frac{3}{4}$
345GS1500	34.5	1200	1500	170	127 $\frac{1}{2}$	120 $\frac{1}{16}$	23 $\frac{3}{32}$	11 $\frac{1}{32}$	19 $\frac{1}{16}$	15	38	46 $\frac{3}{4}$	66 $\frac{3}{4}$	46 $\frac{3}{4}$
460GS1500	46.0	1200	1500	183	138	130 $\frac{1}{2}$	31 $\frac{1}{16}$	15 $\frac{2}{32}$	27 $\frac{1}{16}$	24 $\frac{1}{4}$	48.5	58 $\frac{3}{8}$	93 $\frac{3}{8}$	69 $\frac{1}{4}$
460GS2500	46.0	1200	2500	183	138	130 $\frac{1}{2}$	31 $\frac{1}{16}$	15 $\frac{2}{32}$	27 $\frac{1}{16}$	24 $\frac{1}{4}$	48.5	58 $\frac{3}{8}$	93 $\frac{3}{8}$	69 $\frac{1}{4}$
690GS2500	69.0	1200	2500	195	147	137	34 $\frac{1}{8}$	17 $\frac{1}{16}$	30	26 $\frac{1}{2}$	48.5	58 $\frac{3}{8}$	93 $\frac{3}{8}$	69 $\frac{1}{4}$
690GS3500	69.0	1200	3500	195	147	137	34 $\frac{1}{8}$	17 $\frac{1}{16}$	30	26 $\frac{1}{2}$	48.5	58 $\frac{3}{8}$	93 $\frac{3}{8}$	69 $\frac{1}{4}$

Single Tank Outdoor Oil Breaker Type GS

Wiring Diagrams Pneumatic Mechanism



Dc Control Circuit with Automatic Reclosing Standard A.S.A. Diagram



Auxiliary switches shown for open breaker
Relay contacts shown de-energized.

Pressure switch shown for low pressure.
Open Contact Closed Contact

- O Accessible Terminals
- PR Protective Relay (Remote)
- 101 Control Switch (Remote)
- 143 Toggle Cutoff Switch (Remote)
- 152X Breaker Closing Relay
- 152Y Breaker Closing Cutoff Relay
- 152CC Intake Magnet Valve Coil
- 152TC Breaker Trip Coil
- LCH Latch Check Switch
- LPA Low Pressure Alarm
(Closed on Low Pressure)
- LPC Low Pressure Cutout
(Open on Low Pressure)

Dc control circuit with automatic reclosing
ANSI diagrams

Single Tank Outdoor Oil Breaker Type GS

Specification Details

Included with standard circuit breakers:
 Wemco "C" Universal oil
 Bolted and welded structural steel supporting frame
 Six condenser bushings with power factor test tap, threaded for terminal connections
 Six type BYM bushing current transformers
 Cases and supports for bushing current transformers
 Oil drain valve, filling connection and float type oil gauge
 Mechanical "open" and "close" indicator
 Provision for travel analyzer
 Maintenance closing device (one per station)
 Accelerating springs
 Weatherproof mechanism housing and mechanism (see below)

Pneumatic Mechanism Housing includes:

Pneumatic closing mechanism – 48, 125 or 250 volts dc (specify)
 Shunt trip coil – 48, 125 or 250 volts dc (specify)
 (Refer to Westinghouse if other control voltages or ac control is required)
 Control relay panel with electrically trip free relay
 Air compressor and reservoir with automatic controls, 115/230 volts (±10%) single phase motor
 Three 2 pole fused knife switches; one for control circuit, one for heater circuit, and one for compressor motor
 Necessary terminal blocks
 Type W auxiliary switch, 11 pole
 Type W cutoff switch, 2 pole
 Latch checking switch
 Operation counter
 Two 350 watt space heaters, one thermostatically controlled and one for continuous operation

Optional Equipment Available at Extra Cost:

Pneumatic tank lifter
 Bushing terminals, specify: clamp or tube and size
 Extra creep bushings
 Floodproof mechanism house
 Oil tank heaters
 Key interlock
 Special finishes
 440 volt or three phase motors
 Linear couplers for bus differential relaying
 Metering type current transformers
 Special relays, meters, instruments and cabinet
 Ac capacitor trip
 Tripping battery and charger
 Total hour meter for compressor motor

Standard automatic reclosing equipment available at extra cost, includes the following mounted on hinged panel:

One type RC recloser in Flexitest® case.
 Three type CO overcurrent relays in Flexitest cases
 Three type RA-351 miniature ammeters (5 ampere full scale)
 One type W control switch and indicating lamps
 One toggle switch for automatic operation cutoff
 Type CO ground relay (optional)
 Instantaneous trip on type CO relays (optional)

Instantaneous initial trip with time delay, subsequent trip (optional)

Selector Guide

Standard ANSI Rating: 3 Pole
 2-CO, 15 Seconds Duty Cycle
 Ratings: Ratings based on recommendations of EEI, AEIC, NEMA joint committee on power circuit breakers. For definitions, see Technical Data 33-060.

Type	144GS 1000	230GS 1500	345GS 1500	460GS 1500	460GS 2500	690GS 2500	690GS 3500
Voltage Rating							
Nominal Kv	14.4	23.0	34.5	46.0	46.0	69.0	69.0
Maximum Design, Kv	15.5	25.8	38.0	48.3	48.3	72.5	72.5
Minimum for Rated Mva, Kv	12.0	20.0	23.0	40.0	40.0	60.0	60.0
Current Ratings							
Continuous, 60 Cycle, Amp.	1200	1200	1200	1200	1200	1200	1200
Close and Latch, Amp.	74000	69000	58000	33000	50000	37000	46000
3 Second, Amp.	46000	43000	36000	21000	31000	23000	29000
Interrupting Ratings							
Nominal 3-phase Mva	1000	1500	1500	1500	2500	2500	3500
Maximum Kv, Symmetrical Amp.	36000	33000	22000	17000	28000	19000	26000
Minimum Kv, Symmetrical Amp.	46000	43000	36000	21000	31000	23000	29000
Opening, Cycles	5	5	5	5	5	5	5
Insulation Level							
60 Cycle Test, Kv	50	60	80	105	105	160	160
Impulse, Withstand, Kv	110	150	200	250	250	350	350
Components							
Pneumatic Mechanism, Type	AA-7	AA-7	AA-7	AA-7	AA-7	AA-7	AA-7
De-Ion® Grids, Type	SB-1	SB-1	SB-1	SB-2	SB-2	SB-2	SB-2
Bushing Current Transformers							
Relaying Accuracy	C200	C200	C200	C200	C200	C200	C400
Maximum Rating	1200/5	1200/5	1200/5	1200/5	1200/5	1200/5	1200/5
Additional Available Ratios							
	100	100	100	100	100	100	100
	200	200	200	200	200	200	200
	300	300	300	300	300	300	300
	400	400	400	400	400	400	400
	500	500	500	500	500	500	500
	600	600	600	600	600	600	600
	800	800	800	800	800	800	800
	900	900	900	900	900	900	900
	1000	1000	1000	1000	1000	1000	1000
Condenser Bushing Type	IC	IC	IC	IC	IC	IC	IC
Weight and Oil Requirements							
Net weight with oil, lb.	5000	5000	5000	7800	7800	7800	7800
Shipping weight less oil, lb.	3850	3850	3850	4800	4800	4800	4800
Tank diameter, inches	38	38	38	48.5	48.5	48.5	48.5
Oil capacity, gal.	170	170	170	400	400	400	400
Operating Currents							
Pneumatic Mechanism							
Closing (125 volts dc) amp.	3	3	3	3	3	3	3
Tripping (125 volts dc) amp.	11	11	11	11	11	11	11
Motor (230 volts dc) amp.	4	4	4	4	4	4	4