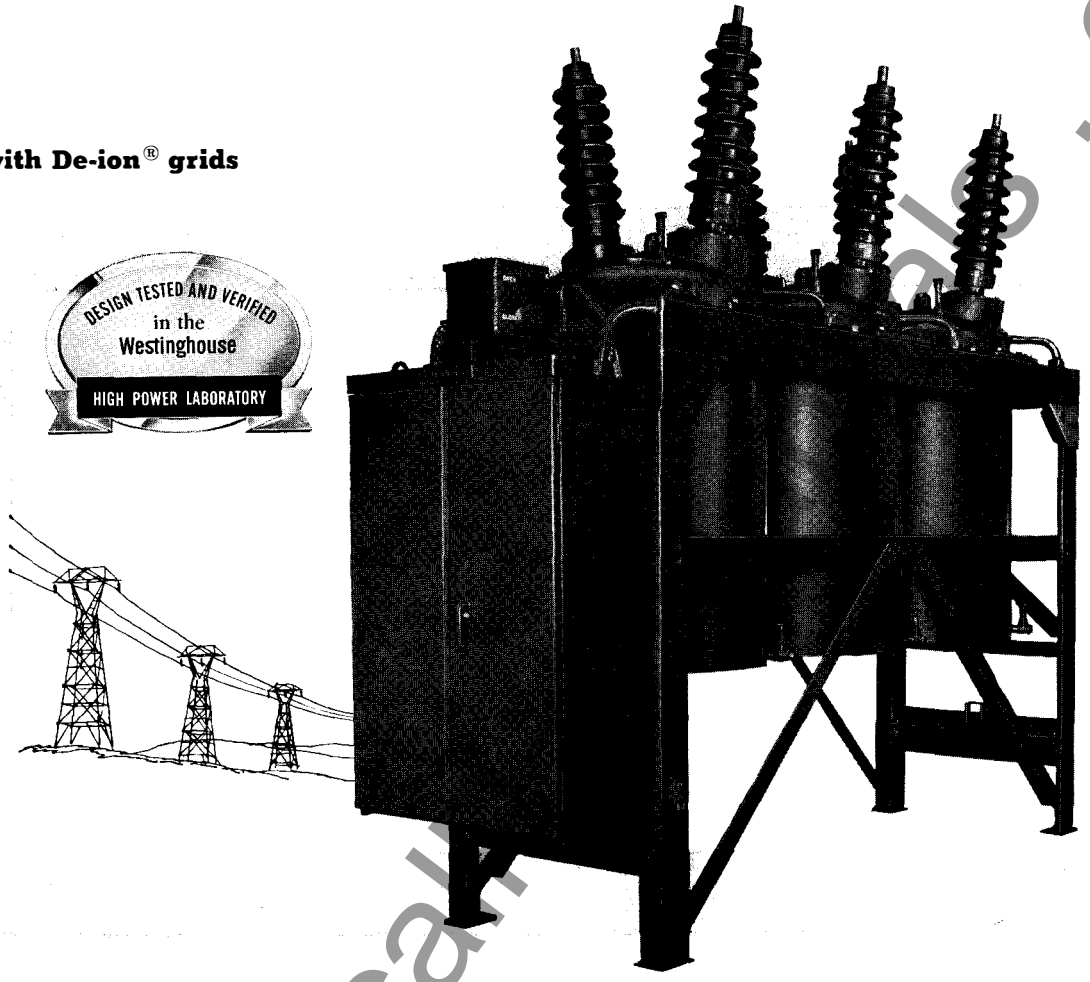
outdoor oil breakers
type G · three tank

14.4 thru 69 kv • 500 thru 2500 mva

with De-ion® grids



application

for 14.4 through 69 kv power transmission systems—20-cycle reclosing and capacitor switching

Type G breakers combine high interrupting capacities, short arcing time and high-speed reclosing with streamlined tank top construction to provide complete reliability, fast fault-clearing and easy maintenance.

advantages

condenser bushing with ASA standard dimensions: Maximum strength with minimum size and weight.

power factor test tap: For quick, ungrounded, bushing power factor tests.

streamlined tank top: Encloses all moving parts, simplifies cleaning and painting.

standard ratings

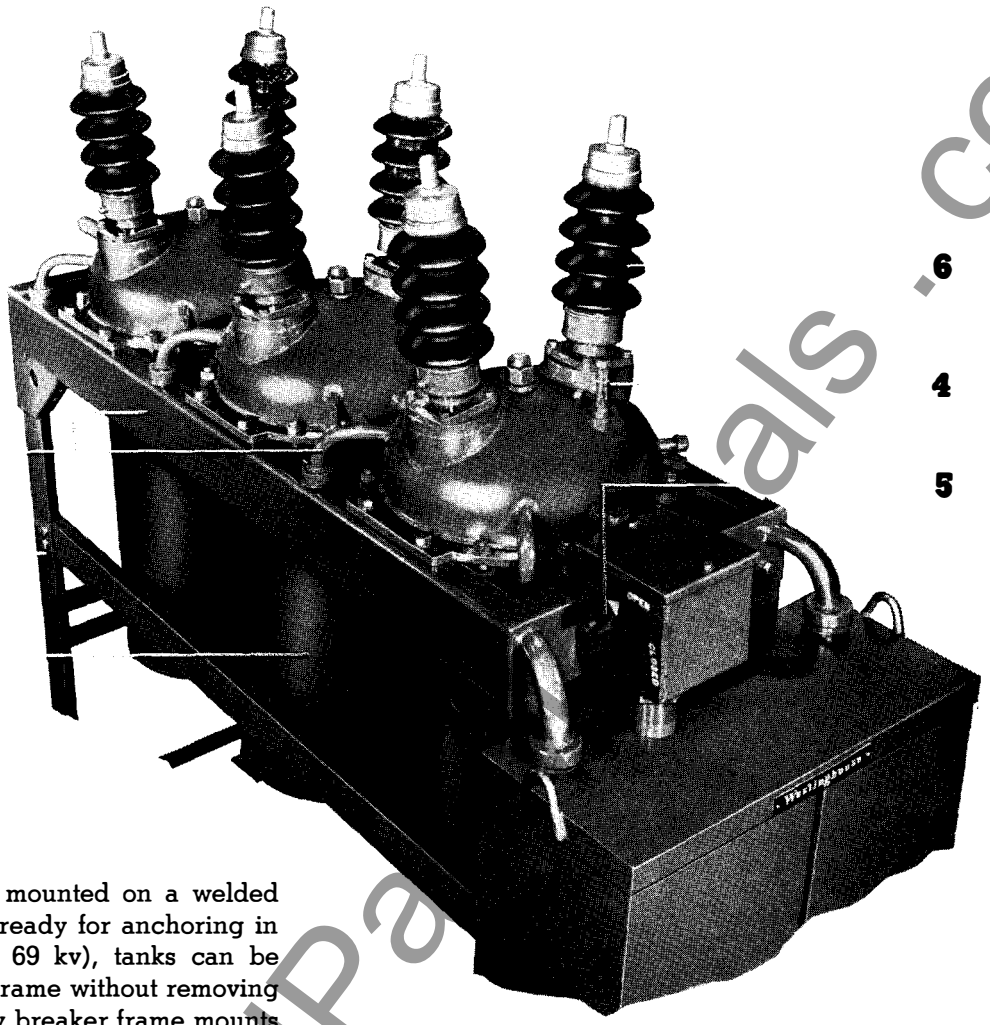
with pneumatic or solenoid operating mechanisms

rated voltage kv	continuous current rating, amps	interrupting capacity 3-phase, mva
14.4	1200	1000
	3000	1500
	4000	1500
23	1200	500
34.5	1200	500
	1200	1000
	1200	1500
	2000	2500
46	1200	500
	1200	1500
69	1200	1000
	1200	1500
	1200	2500

interrupting time:
14.4 through 69 kv.....5 cycles
except 2000-3000-4000 amp..8 cycles

January, 1961
supersedes DB 33-252, dated July, 1956
mailed to: E/280/DB; C/331/DB

design features



Type G circuit breakers are mounted on a welded frame and shipped as a unit ready for anchoring in place. In all ratings (except 69 kv), tanks can be lowered and slid clear of the frame without removing structural members. The 69-kv breaker frame mounts on a separate subframe to permit shipping assembled and yet provide clearance for tank removal.

Top frame member doubles as a weatherproof wiring trough. Wiring is accessible underneath through a removable plate.

Bushing current transformer leads are brought out through conduit to wiring trough. All tap leads are run through wiring trough to readily accessible terminal blocks in the operating mechanism housing. Pressure seals prevent oil or arc gas passing from the tank to the trough and are easily removed for changing transformer leads.

Deep drawn steel tank tops enclose pole unit lever assemblies, giving greater accessibility to moving parts. The resulting streamlined top design makes cleaning faster and easier. Tanks are seam-welded steel boiler plate, hydrostatically pressure-tested. The large diameter base provides stability when the tank is lowered.

Float-type oil gauge on each pole unit gives positive indication of oil level without leakage.

optional tank lifter

For raising and lowering pole tanks, pneumatic tank lifters are available.

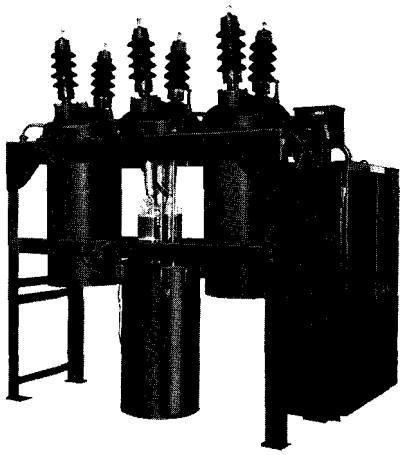
1 wiring trough

2 frame

3 tank

4 float-type oil gauge

5 mechanical position indicator



6 condenser bushings

The type IC condenser bushings rated 1200 amperes, 23 kv through 69 kv are manufactured to ASA 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 ASA 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.

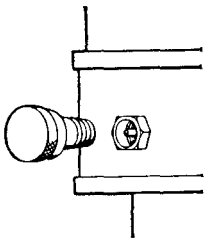
For ratings through 46 kv the entrance conductor is a hollow copper stud threaded for terminal connection. Insulating layers of treated paper are wound around the stud under heat and pressure. Treating compound in the paper binds them into a homogeneous insulation.

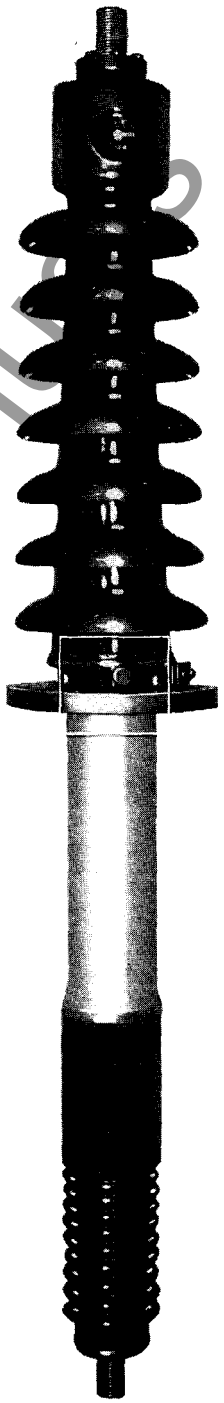
Interspersed at regular intervals between the paper layers are sheets of metal foil, which form condenser plates. This series of condensers distributes the voltage stress evenly through and across the insulation.

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 by 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.

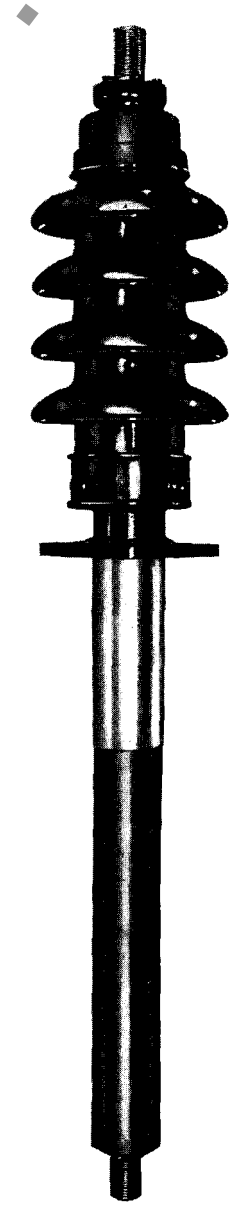
The 1200 ampere, 69 kv rating is oil filled, type O construction.

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.





69 kv

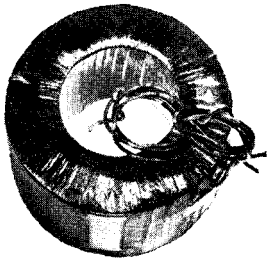


23 through 46 kv

bushing current transformers

On standard breakers, a multi-ratio current transformer is provided on each bushing. These current transformers meet all ASA and NEMA requirements for relaying and indicating instrument applications. If additional standard accuracy current transformers are required, a total of two per bushing can be supplied. Additional current transformers can be installed on customers' breakers at any time without disturbing the mounting of the original transformers.

ASA metering accuracy single-ratio current transformers can be supplied in place of, or in addition to, relaying transformers. Linear couplers can be supplied for bus differential protection.

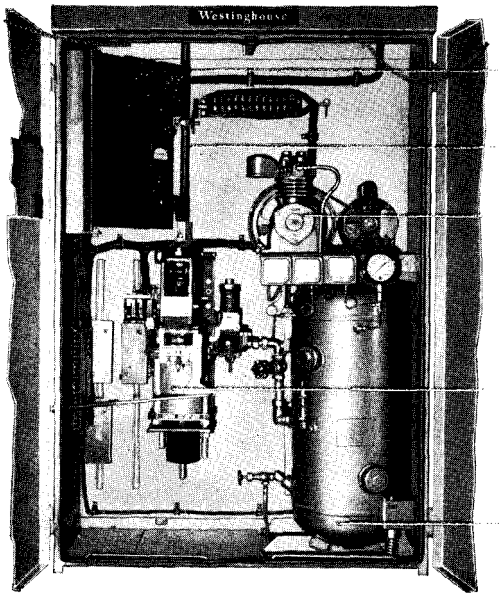


design features, continued

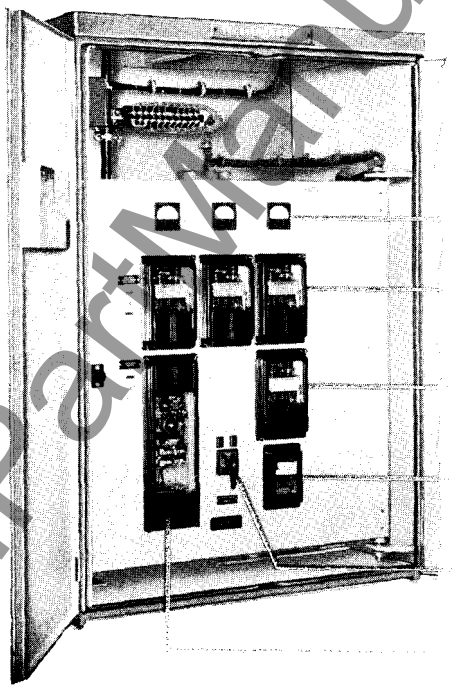
operating mechanisms

completely weatherproof • mechanically and electrically trip-free
two hinged doors for easy access to all parts

pneumatic mechanism



pneumatic mechanism with high-speed reclosing



Type AA electro-pneumatic mechanisms are fast operating with low control currents, and are particularly suited for high-speed reclosing or installations with limited station battery capacity. Mechanisms are mechanically and electrically trip-free with unrestrained opening under all conditions.

Mechanism includes automatically controlled motor-driven compressor, storage reservoir, pressure relay, pressure gauge, safety valve and condensate drain valve. At normal pressure, reservoir holds enough air for five successive closings without compressor operation. Air supply meets all ASME, state and insurance codes.

For complete listing of electrical control components included, see "specification details" on page 11.

Pneumatic mechanisms can be supplied with reclosing equipment suitable for 20-cycle reclosing. Three reclosing schemes are available:

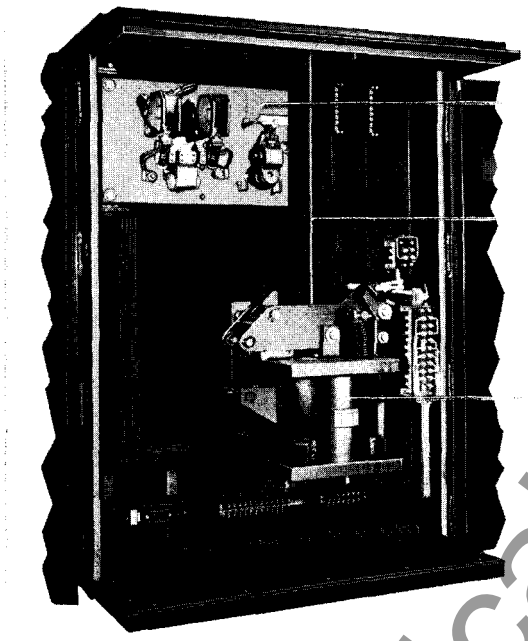
RC recloser: Three-shot reclosing with automatic reset, first reclosure instantaneous or time delay, automatic lockout after third reclosure.

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

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

For typical SGR-12 scheme, see "wiring diagram," page 8. See "specification details," page 11, for complete equipment listing.

solenoid mechanism

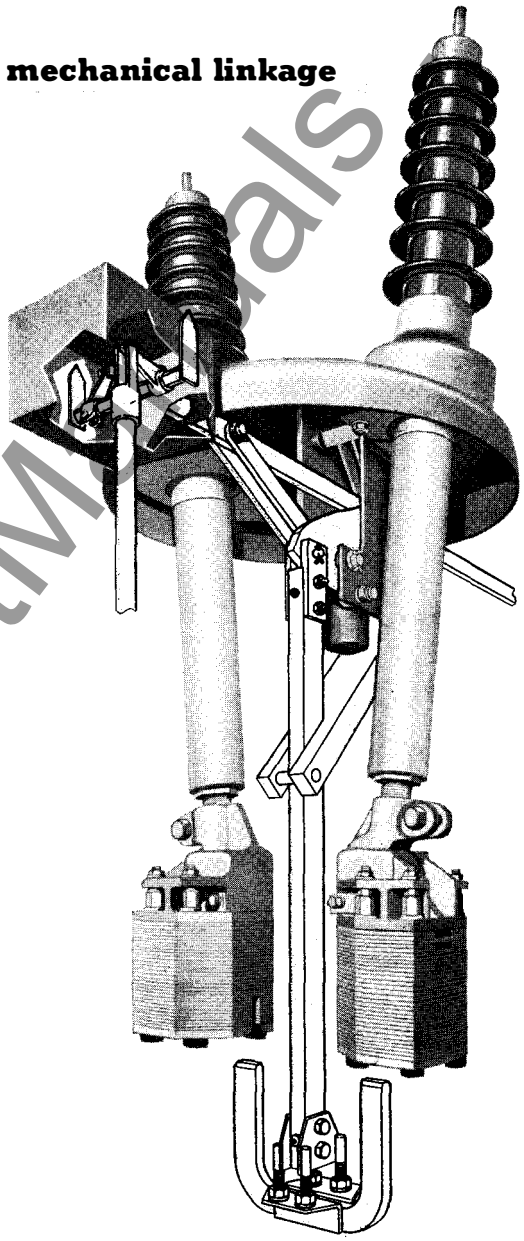


Type SAF solenoid mechanisms provide reliable operation for standard closing or 45-cycle reclosing. Operation is from d-c station battery, or from a-c source when equipped with Rectox® rectifier.

Mechanism is mechanically and electrically trip-free in all positions. Breaker can be tripped free in any position without de-energizing the closing coil.

Standard control components include control relays, closing coil, auxiliary switch and shunt trip coil. Transformer trip and undervoltage trip devices can also be supplied, see "specification details" on page 11.

mechanical linkage



For high-speed opening and closing, mechanism travel is straight through: Mechanism pull rod through bell crank to horizontal pull rod to individual pole levers which open and close the contacts. The forward motion of the horizontal pull rods also compresses the heavy accelerating springs, allowing low control energy tripping. Dashpot dampers control only the last few inches of opening travel to cushion shock and prevent bouncing without sacrificing speed. Lift rods and guides are high-strength Micarta®, non-conducting and oil resistant—with mechanical strength to withstand impact shock. Streamlined tank top gives access to all adjustments.

design features, continued

interrupting mechanism

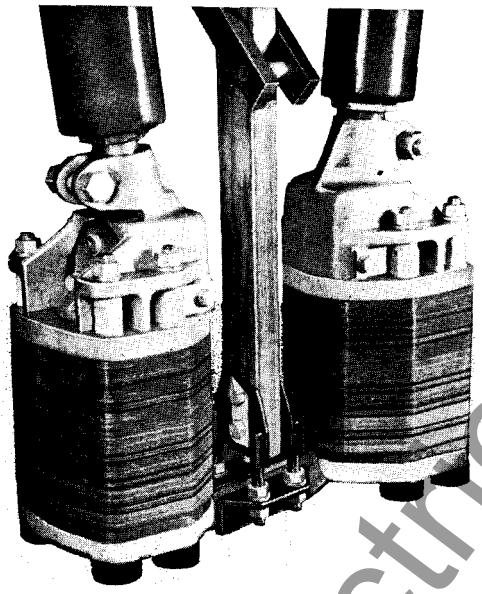
moving contacts

for maximum capacity, all contacts will carry . . .

- continuous-current rating without exceeding 30°C rise
- momentary and interrupting-current ratings without damage

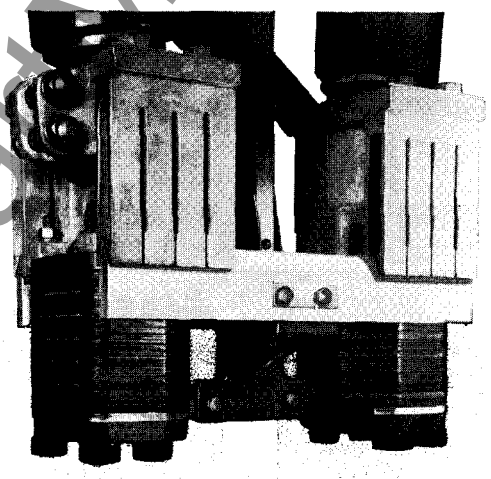
Completing the current path from bushing to bushing, all contacts are pressure-held to insure low contact resistance. Curved shape and rounded edges minimize dielectric stresses. All contacts are easily adjusted.

for 1200 amperes



Breakers rated 1200 amperes are equipped with a single set of contacts for each pole. Blade-type moving contacts are hard-drawn copper with brazed copper-tungsten arcing tips. When breaker is closed, the blades extend well into the De-ion grids where they are gripped between spring-backed stationary contact fingers.

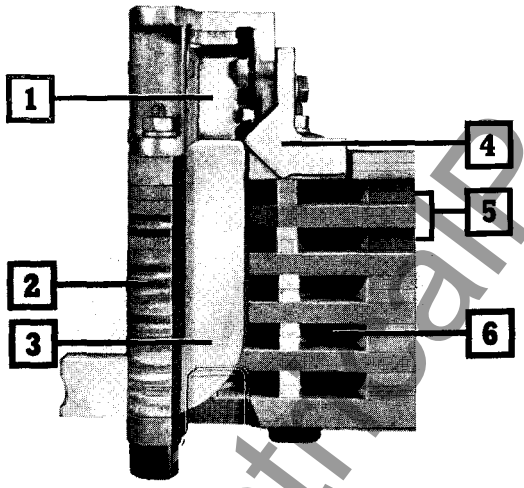
for 2000 amperes and above



Breakers rated 2000 amperes and above have "tuning fork" main contacts in parallel with the blade contact and external to the interrupter. Main contacts are silver plated, copper alloy with extremely high conductivity. When breaker opens, main contacts part first; and when closing, the reverse holds true, with the blade contacts making first and the main contacts following. Thus arcing is confined to blade contacts within the De-ion grid.

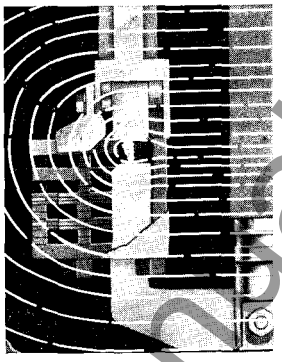
De-ion grid construction

1. **finger-type contact**
2. **fiber plates**
3. **blade contact with copper tungsten tip**
4. **arc horns**
5. **exhaust vents**
6. **oil pockets**

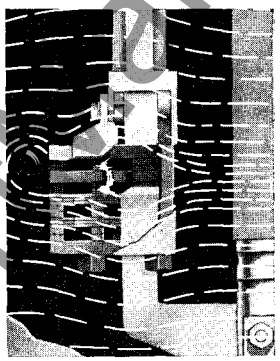


De-ion grids for type G breakers are built as a vertical stack of fiber plates. Plates are cut out in the center for moving contact travel, with pockets for trapping oil and vents to release arc gas. Atop the grid mount two spring-backed stationary finger contacts which part slightly to hold the moving blade contact with proper pressure over entire contact surface. Arcing horn is faced with arc-resistant alloy.

arc extinction



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

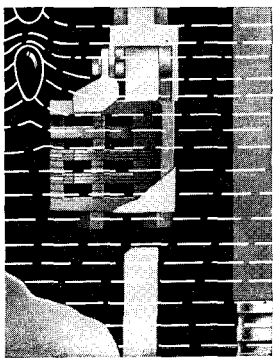


2. The top section interrupts high current arcs with a minimum of arc length and energy. It is composed of oil pockets, vent plates and a splitter plate. When a high current arc is drawn, pressure builds up quickly in this section.

The gasses formed are vented through the channels 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 grid is composed of alternate oil pockets and close-fitting plates which serve to interrupt a middle range or low current.

During low current interruptions, 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 oils. The arc is lengthened and cooled, causing rapid deionization and interruption.



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

wiring diagram

pneumatic mechanism

d-c control circuit with automatic reclosing standard AEIC diagram

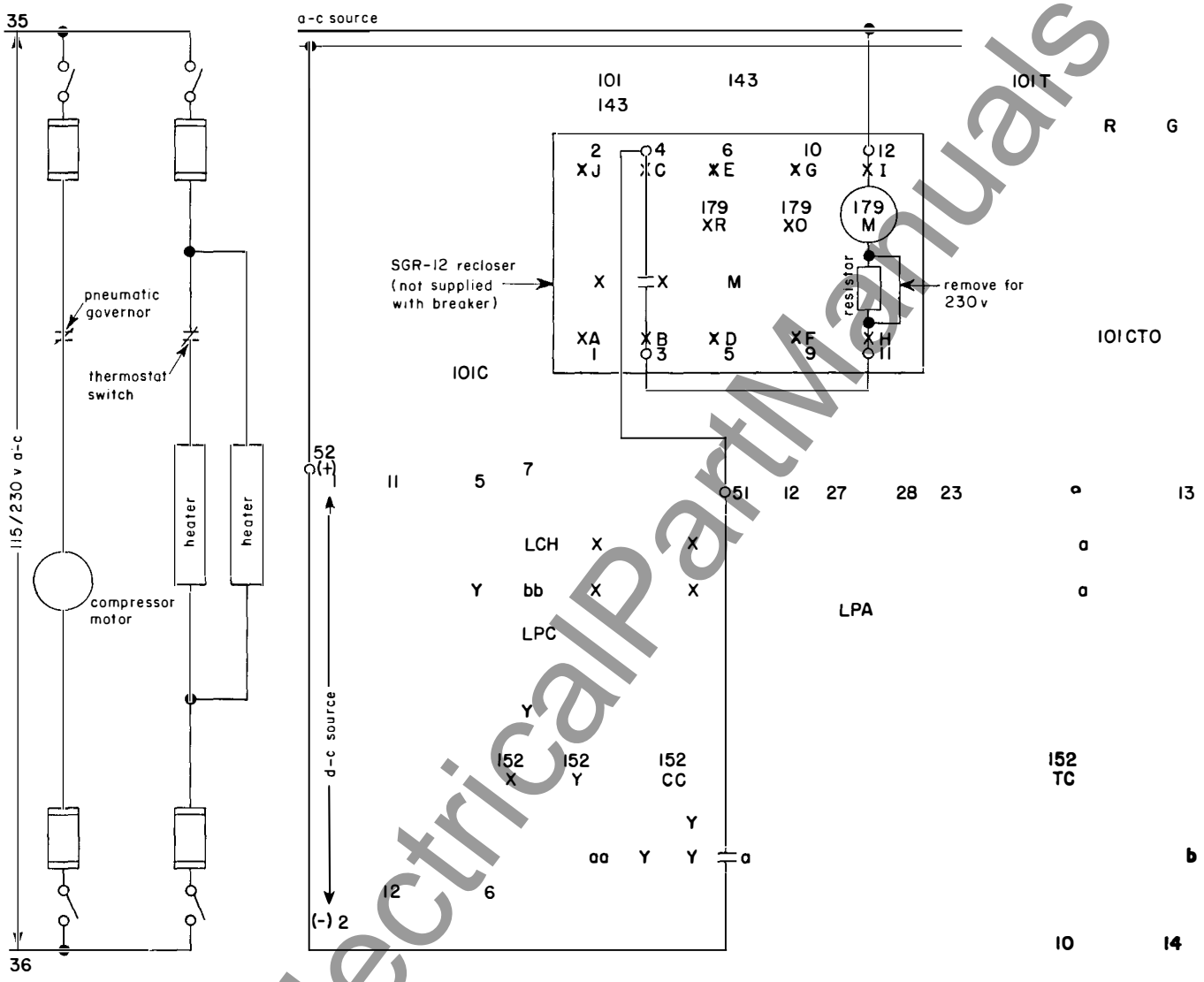


diagram in accordance with A. E. I. C. industry standard

legend

note: 1. auxiliary switches shown for open breaker
2. relay contacts shown de-energized
3. pressure switch shown for low pressure

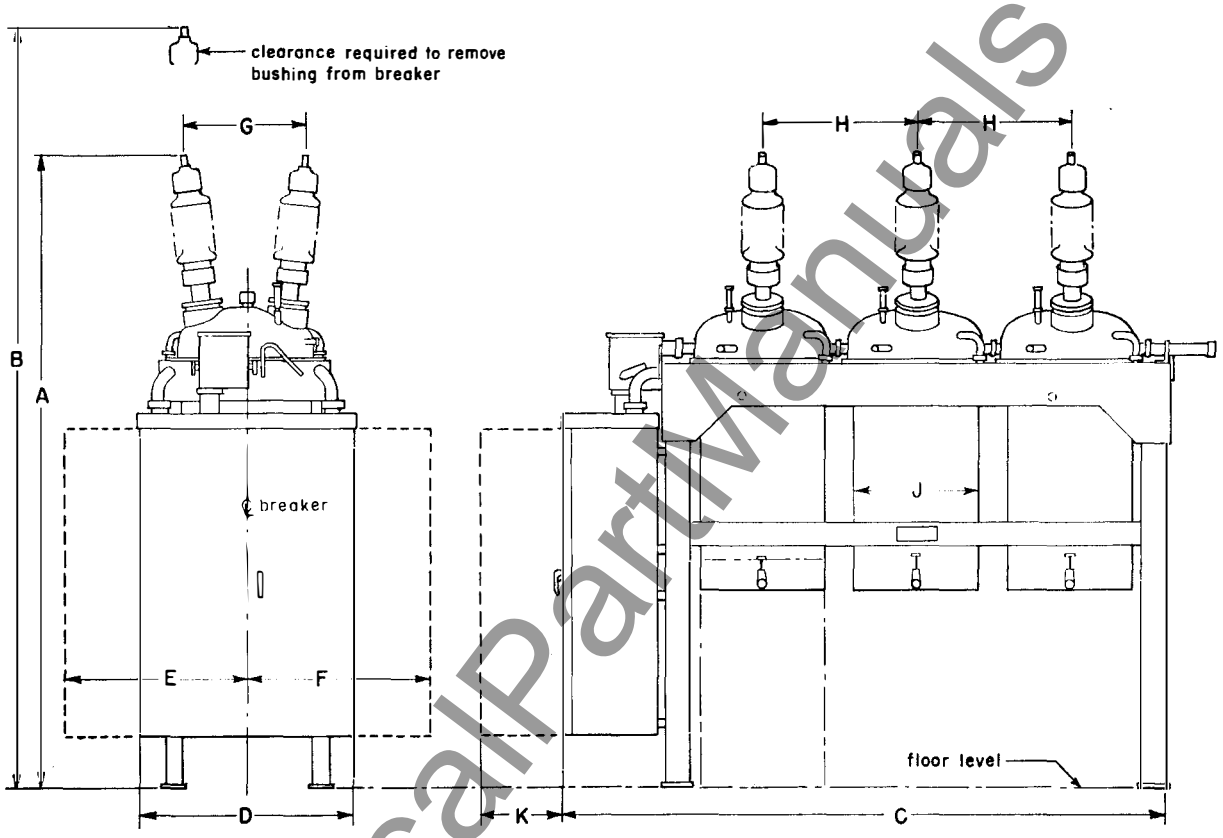
152CC intake magnet valve coil
152TC trip coil
LCH latch check switch
LPA low pressure alarm (closed on low pressure)
LPC low pressure cut-off (open on low pressure)

101 control switch
143 toggle switch
—O— accessible terminals
—| |— open contacts
—/ /— closed contacts
——— a-c
d-c

outdoor oil breakers
type G • three tank

14.4 thru 69 kv • 500 thru 2500 mva

dimensions in inches • approximate, not for construction purposes



type	A	B	C	D	E	F	G	H	J	K
144G1000-1200A	117½	158	119	42	39	42	21½	30½	24½	22
144G1500-3000A	127¾	169½	139	60½	53½	61¾	22⅝	34½	28½	31
144G1500-4000A	128¾	170	145	60½	53½	61¾	24	36½	30½	31
230G500	117½	158	119	42	39	42	21½	30½	24½	22
345G500	121⅝	163	119	42	39	42	22⅜	30½	24½	22
345G1000	121⅝	163	119	42	39	42	22⅜	30½	24½	22
345G1500	121⅝	163	119	42	39	42	22⅜	30½	24½	22
345G2500	131¾	175½	147	60½	53½	61¾	24	36½	30½	31
460G500	124⅞	168½	131	42	39	42	28¾	34½	30½	22
460G1500	124⅞	168½	131	42	39	42	28¾	34½	30½	22
690G1000	141 3/16	189¼	151	44⅜	39	42	34⅝	41	36¼	22
690G1500	141 3/16	189¼	151	44⅜	39	42	34⅝	41	36¼	22
690G2500	141 3/16	189¼	151	44⅜	39	42	34⅝	41	36¼	22

selector guide

standard ASA ratings: 3-pole • 2-CO 15 sec. duty cycle

	type	144G1000	144G1500		230G500	345G500	345G1000	345G1500	345G2500
ratings:	Ratings based on recommendations of EEI—AEIC—NEMA joint committee on power circuit breakers. For definitions, see technical data 33-060								
voltage ratings	rated ..... kv	14.4	14.4	14.4	23.0	34.5	34.5	34 5	34.5
	maximum design ..... kv	15.5	15.5	15.5	25.8	38.0	38.0	38.0	38.0
	min. for rated mva ..... kv	12.0	12.0	12.0	12.0	23.0	23.0	23.0	23.0
current ratings	continuous, 60 cycle ..... amp	1200	3000	4000	1200	1200	1200	1200	2000
	momentary ..... amp	77000	115000	115000	38000	20000	40000	61000	96000
	4-second ..... amp	48000	72000	72000	24000	12600	25000	38000	60000
interrupting ratings	3-phase ..... mva	1000	1500	1500	500	500	1000	1500	2500
	rated voltage ..... amp	40000	60000	60000	12600	8400	17000	25000	42000
	maximum ..... amp	48000	72000	72000	24000	12600	25000	38000	60000
	opening ..... cycles	5	8	8	5	5	5	5	8
insulation level	60-cycle test ..... kv	50	50	50	60	80	80	80	80
	impulse withstand ..... kv	110	110	110	150	200	200	200	200
components									
pneumatic mechanisms ..... type		AA-7	AA-10	AA-10	AA-7	AA-7	AA-7	AA-7	AA-10
solenoid mechanism ..... type		SAF-4	SAF-6	SAF-6	SAF-4	SAF-4	SAF-4	SAF-4	SAF-6
De-ion grids ..... type ▲		144C (LDH)	144C (LDH)	144C (LDH)	230A (F)	345B (DH)	345B (LDH)	345B (LDH)	345B (CDH)
bushing current transformers	relaying accuracy	10L200	10L400	10L800	10L200	10L200	10L200	10L200	10L400
	maximum ratio	1200/5	3000/5	4000/5	1200/5	1200/5	1200/5	1200/5	2000/5
	available taps ..... amp	100 600 200 800 300 900 400 1000 500 1200/5	1500 2000 3000/5	2000 3000 4000/5	100 600 200 800 300 900 400 1000 500 1200/5	100 600 200 800 300 900 400 1000 500 1200/5	100 600 200 800 300 900 400 1000 500 1200/5	100 600 200 800 300 900 400 1000 500 1200/5	300 1100 400 1200 500 1500 800 1600 2000/5
condenser bushings ..... type		IC	S	S	IC	IC	IC	IC	S
weight and oil requirements									
net weight with oil ..... lb		6400	8600	10800	6300	6550	6550	6550	9800
shipping weight without oil ..... lb		5500	7800	9000	4900	5200	5200	5200	8000
tank diameter ..... in.		24	28	30	24	24	24	24	30
oil capacity ..... gal.		220	275	340	220	220	220	220	340
operating currents									
pneumatic mechanism	closing (125v, d-c) ..... amp	9	9	9	9	9	9	9	9
	tripping (125v, d-c) ..... amp	10	10	10	10	10	10	10	10
	motor (230v, a-c) ..... amp	4	5	5	4	4	4	4	5
solenoid	closing (125v, d-c) ..... amp	120	175	200	120	120	120	120	175
	tripping 125v, d-c ..... amp	10	10	10	10	10	10	10	10

▲ Previous designation shown in parenthesis.

460G500	460G1500	690G1000	690G1500	690G2500
46.0	46.0	69.0	69.0	69.0
48.3	48.3	72.5	72.5	72.5
40.0	40.0	60.0	60.0	60.0
1200	1200	1200	1200	1200
12000	35000	16000	23000	38000
7200	22000	9600	14500	24000
500	1500	1000	1500	2500
6300	19000	8400	12600	21000
7200	22000	9600	14500	24000
5	5	5	5	5
105	105	160	160	160
250	250	340	350	350
AA-7	AA-7	AA-7	AA-7	AA-7
SAF-4	SAF-4	SAF-4	SAF-4	SAF-6
460A (CD)	460B (CDH)	690A (CD)	690A (CDH)	690A (CDH)
10L200	10L200	10L400	10L400	10L400
1200/5	1200/5	1200/5	1200/5	1200/5
100 600 200 800 300 900 400 1000 500 1200/5	100 600 200 800 300 900 400 1000 500 1200/5	100 600 200 800 300 900 400 1000 500 1200/5	100 600 200 800 300 900 400 1000 500 1200/5	100 600 200 800 300 900 400 1000 500 1200/5
IC	IC	IC	IC	IC
8400	8400	12500	12500	12500
6500	6500	7900	7900	7900
30	30	36	36	36
350	350	615	615	615
9	9	9	9	9
10	10	10	10	10
4	4	4	4	4
120	120	170	170	170
10	10	10	10	10

specification details

included with standard circuit breaker:

Wemco® "C" universal oil
welded structural steel frame with integral wiring troughs
six condenser bushings with power factor test tap, threaded for terminal connection
bushing terminals, specify: type (clamp or tube) and size
six type BYM bushing current transformers
cases and supports for bushing current transformers
weatherproof metal conduit for transformer leads to wiring trough
oil drain valve, filling connection and sight gauge for each pole unit mechanical "open" and "closed" indicator
accelerating springs maintenance closing device (one per station)
weatherproof mechanism housing and mechanism (see below)

pneumatic mechanism housing includes:

pneumatic closing mechanism, 48, 125 or 250 volts d-c (specify)■
shunt trip coil, 48, 125 or 250 volts d-c (specify)■
control relay panel with electrically trip-free control relay
■ Refer to Westinghouse if other control voltages or a-c control required
air compressor and reservoir with automatic controls, 115/230-volt, (± 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 thermostatically controlled space heaters

solenoid mechanism housing includes:

solenoid closing mechanism 125 or 250 volts d-c (or 230 volts a-c Rectox-Solenoid 46 kv or below) specify
shunt trip coil; 48, 125 or 250 volts d-c(specify)
type W auxiliary switch, 10-pole
1 fused knife switch for control circuit
necessary terminal blocks cutoff switch
operation counter space heaters

optional equipment available at extra cost

(for details see price lists 33-220 and 33-240)

resistor grids for capacitor switching: see technical data 33-063
flood-proofed mechanism housing
extra creepage bushings high altitude bushings
linear couplers for bus differential relaying
expansion terminals key interlocks
thermostats for solenoid mechanism housing heaters
440-volt control or three-phase motor for pneumatic reclosing
special relays, meters, instruments and cabinets
Rectox Solenoid operated breakers 69 kv and above
a-c trip capacitor

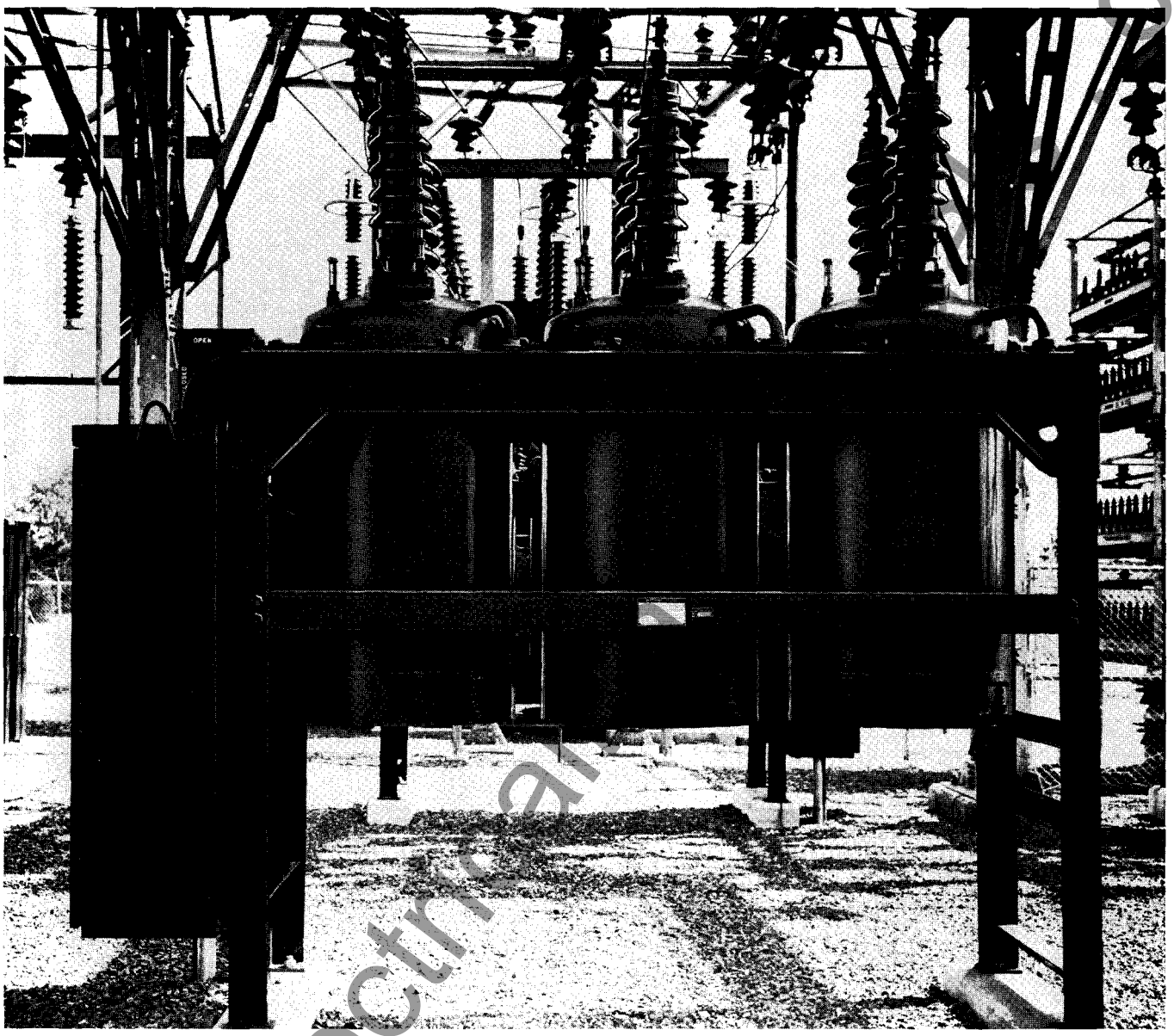
automatic reclosing equipment, available at extra cost, includes the following mounted on hinged panel:

reclosing relay, type RC or SGR-12
three overcurrent relays, type CO
three panel ammeters, type R-35
type W control switch and indicating lamps
(optional) overcurrent ground relay, type CO

accessories

pneumatic tank lifter

outdoor oil breakers
type G • three tank



further information:

prices: price list 33-220

AA-mechanisms: descriptive bulletin 33-350
condenser bushings: descriptive bulletin 33-354
De-ion grids: descriptive bulletin 33-355
bushing current transformers: descriptive bulletin 33-356

Westinghouse Electric Corporation
Power Circuit Breaker Dept.: East Pittsburgh Division • Trafford, Pa.
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