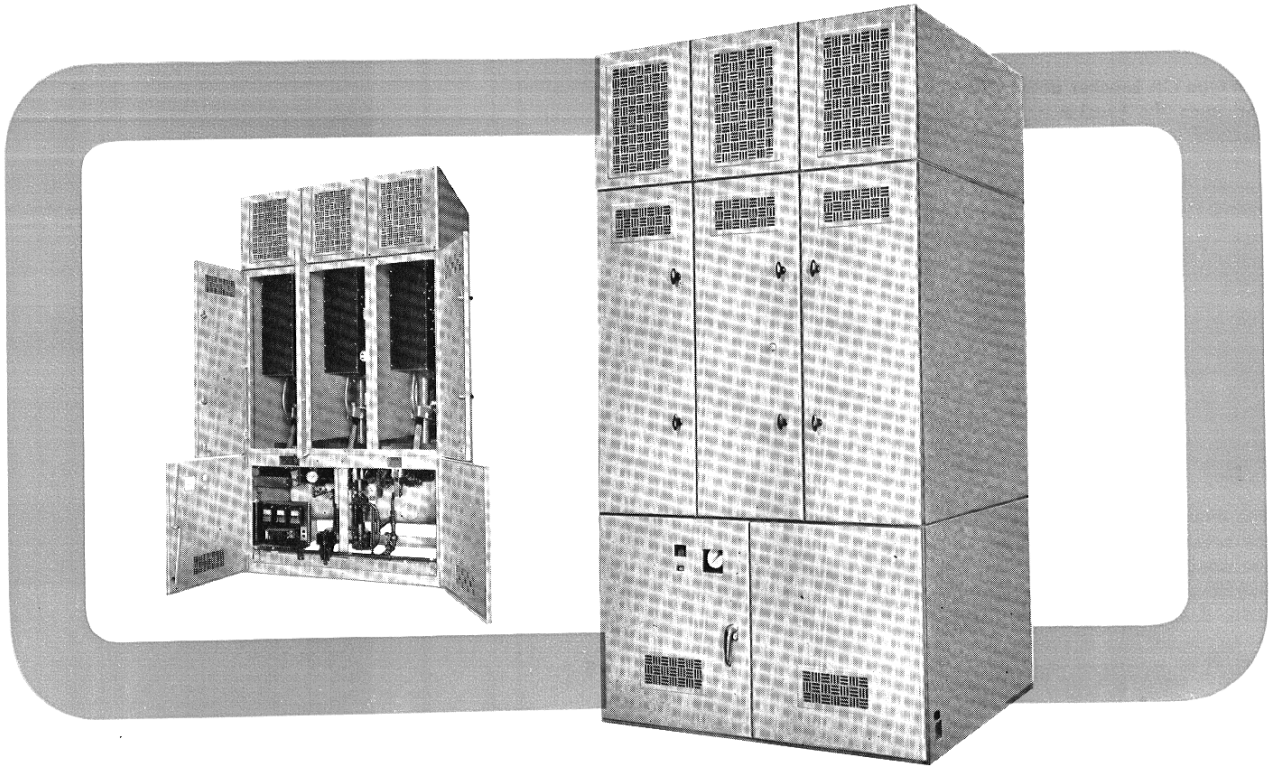
compressed air breakers

type CA • indoor

metal enclosed • 1200 to 7000 amperes
1000 to 2500 mva interr capacity • 14.4 to 34.5 kv



application

type CA compressed air circuit breakers are designed for heavy-duty indoor power house and substation service where high interrupting capacity and elimination of oil hazard are required.

advantages

compact design: Breaker weights and dimensions have been reduced.

straight-line air flow: Efficient arc interruption is produced by a powerful blast of compressed air flowing in a direct line from the reservoir through the arc chutes.

accessible contacts: Contact surfaces and arc splitters can be inspected without removing the arc chute.

multiple tuning fork stationary contacts made of Cupaloy, insure good contact without the use of shunts and springs.

silver-tipped copper bars, each under spring pressure, form conducting shunts between the moving contact arm and the stationary contact.

positive air blast for arc control is assured by opening the blast valves mechanically before the contacts separate.

high speed contact operation: Pneumatic operating mechanism imparts high speed to the contacts, reducing the arcing time and permitting closing without air blast.

December, 1960
supersedes descriptive bulletin 33-450, dated July, 1957
mailed to: E/277/DB; C/334/DB

design features

The type CA breaker utilizes stored compressed air both to close and open the breaker and for arc interruption. High pressure blasts of air from the reservoir are directed upward into the arc path and force it into the arc chute where the turbulent air flow quickly extinguishes the arc and hot ionized gases are cooled before they pass into the atmosphere. Separate air supply units must be provided to feed compressed air into the breaker storage reservoirs.

The breakers are mounted in steel enclosures. They can also be incorporated into Westinghouse Station-type Cubicle Switchgear.

compartments and features

a interrupter compartment

The interrupting compartment contains the high voltage parts of the breaker. Steel barriers separate this compartment from the operating mechanism compartment and the diffusion chamber. Individual removable steel barriers separate each pole unit.

b operating mechanism compartment

The lower compartment contains the air reservoir, blast valves, pneumatic operating mechanism, and control panel. Grounded steel barriers isolate this compartment from the high voltage section above.

The mechanism compartment is readily accessible for inspection and maintenance at ground level when the doors are open.

1 diffusion chamber

Exhaust gases are confined and diffused before venting into the surrounding air.

2 enclosure

3 arc chute

4 cooler assembly

5 stationary contacts

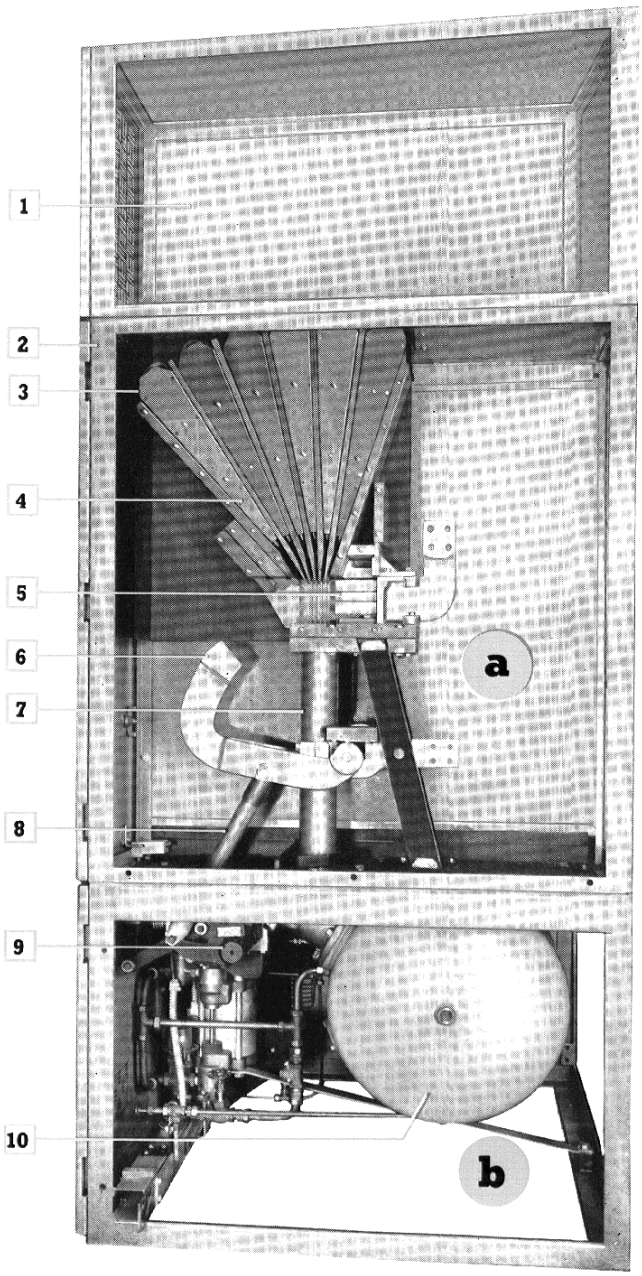
6 moving contacts

7 blast tubes

8 operating rods

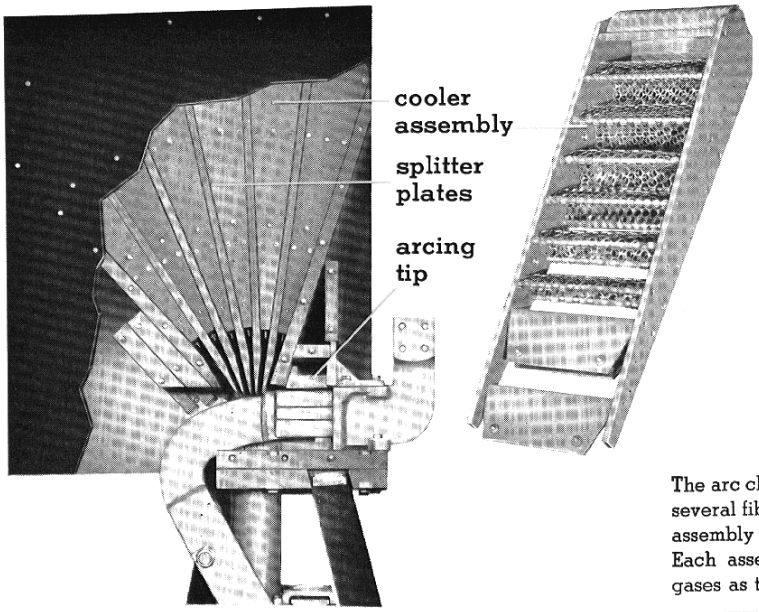
9 operating jack shaft

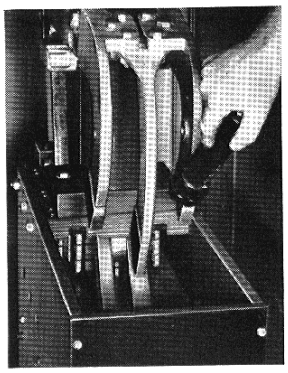
10 compressed air supply



a interrupter compartment

arc chute

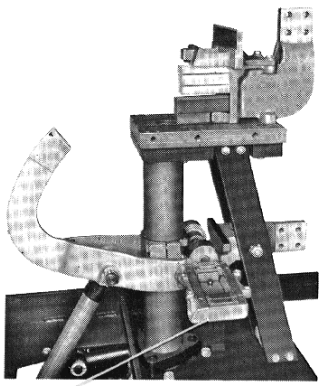




Contacts and splitter plates are easily inspected without removing the arc chute.

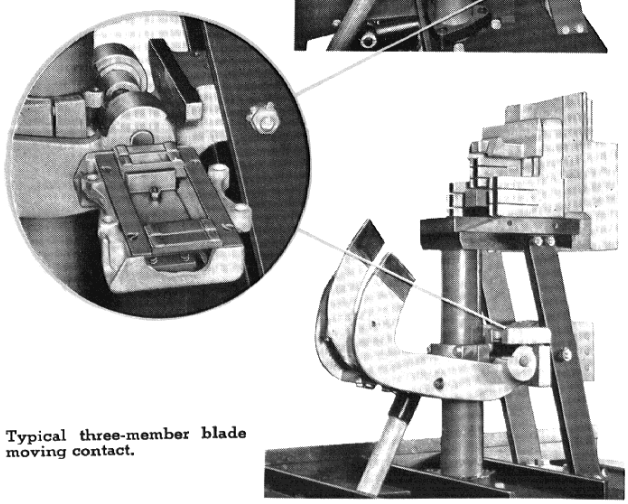
The arc chute is a fibre-lined Micarta box of fixed width containing several fibre arc splitter plates and cooler assemblies. Each cooler assembly contains a series of metal screens to cool the arc gases. Each assembly is V-shaped to allow free expansion of the arc gases as they pass upward into the diffusion chamber.

breaker contacts



right—Typical single-member blade moving contact.

below—Bridging member inverted and cut away to show spring-biased contacts.



Typical three-member blade moving contact.

Both stationary and moving contacts are Cupaloy castings with silver-plated contact surfaces and with special arc-resisting metal inserts at points of arcing.

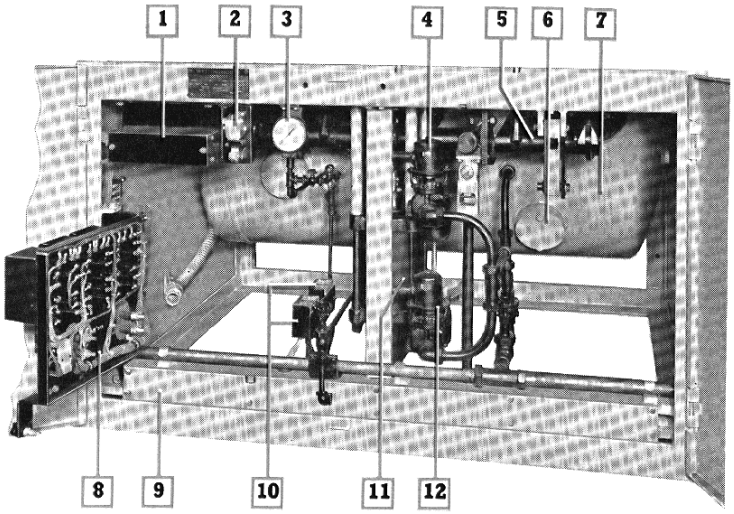
stationary contacts, bolted to the main stationary terminal casting, consist of Cupaloy fingers machined to give proper deflection when contact is closed. This construction completely eliminates the use of shunts and springs. As the contacts separate, the air blast and magnetic forces quickly move the arc from the stationary contact fingers to an Elkonite tip mounted directly above, thus protecting the fingers from arcing.

moving contacts are curved blades, each blade hinged at its base to the lower terminal. This assembly is supported by the blast tube and Micarta braces. Single-member blades are used on 1200, 2000, and 3000-ampere breakers. Three-member blades, used for breakers rated 4000 amperes and above, are so arranged that contact is always made and broken on the center blade member. Arcing surfaces of these blades are protected by arc-resisting metal inserts.

bridging members, each individually spring-biased, conduct the current across the hinge joint. Correct contact pressure is obtained without adjustment, and wiping action maintains the silver-to-silver contact. Close contact adjustment at this point has been eliminated. The contact assembly is easily removable for inspection and maintenance.

operating rods, connecting the moving contact to the operating jack shaft, are made of wood-base Micarta with wired-on metal rod ends. Double-threaded grooves are machined on the rod, with matching grooves on the rod ends. The two pieces are assembled with a turning action which threads a wire into the grooves. These rods combine high insulating quality with high mechanical strength.

b operating mechanism compartment



1. auxiliary switch
2. position indicator and operation counter
3. air pressure gauge
4. mechanism open valve
5. operating jack shaft
6. inspection openings in air reservoir
7. air storage reservoir
8. control panel
9. wiring trough
10. pressure switches
11. pneumatic operating mechanism
12. mechanism close valve

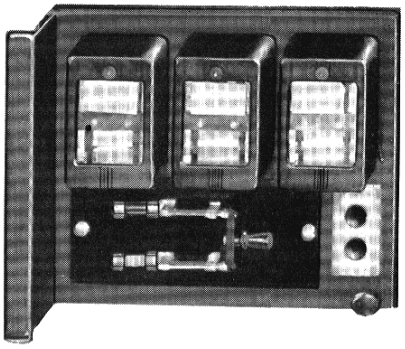
pneumatic operating mechanism

The pneumatic operating mechanism consists of electrically-operated air valves, cylinder, piston, and connecting rod. The connecting rod connects directly to the main operating jack shaft, which also operates the blast valves, contact operating rods, and the shock absorbers.

The air piping from the mechanism to the reservoir and pressure valves is made of copper tubing with threadless-type pressure fittings having Neoprene seals that provide flexibility and eliminate on-the-job soldering. All parts in contact with air flow are made of non-corrosive materials.

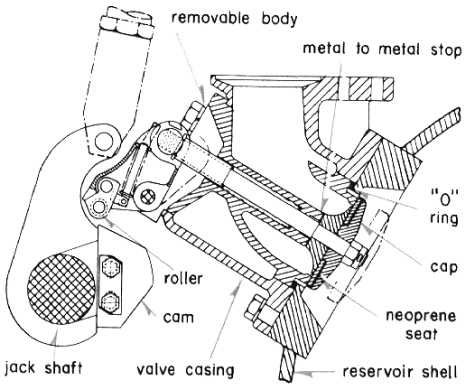
The breaker contacts are held in the closed position by an over-center toggle. Two magnet valves control the open and close operations through functional dump valves. These valves are so arranged that when air pressure is admitted on one end of the cylinder, the other end will exhaust to atmosphere, and conversely. The pressure surface on the upper valve is greater than that of the lower valve; therefore, pneumatically the opening operation always takes preference over the closing. With normal closing or opening operations, the operating air is slowly released from the air cylinder after the operation is complete, but when immediate reversal is required the operating air is immediately exhausted by operation of the opposing valve.

control accessories

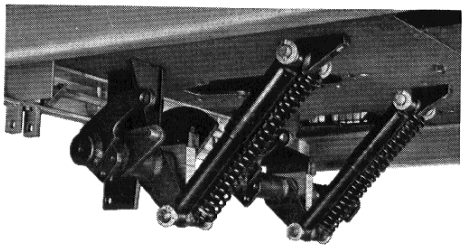


control panel is provided to make opening and closing operations on the breaker entirely automatic once the operator has moved the control switch either to close or trip the breaker. The control relays automatically govern the flow of compressed air to the mechanism and de-energize all magnet valve coils and relays after a closing or opening operation has been completed

blast valves



shock absorbers



pressure switches are connected to the central control system and adjusted so as to allow operation of the breaker only so long as the compressed air pressure does not fall below the recommended minimum. A safety valve relieves the pressure if it exceeds the maximum. An alarm switch is provided to close its contacts when the pressure falls below the recommended normal.

air pressure gauge, mounted on the front of the breaker where it is visible at all times, indicates the air pressure in the reservoir. A red and green flag indicator and an operation counter are also mounted on the breaker. These devices are all visible through openings provided in the hinged front doors.

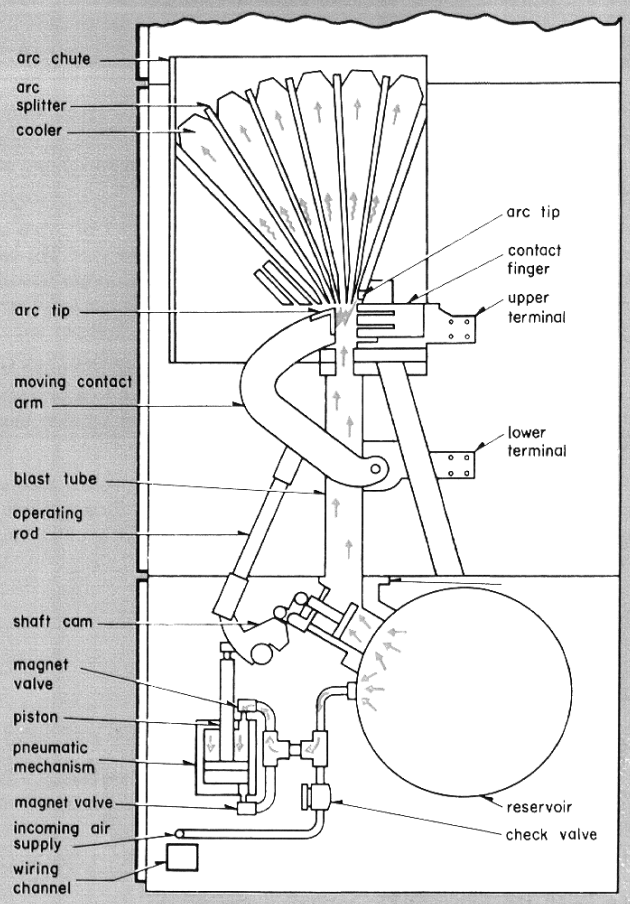
control wiring is either enclosed in conduit or made behind the hinged control panel to prevent accidental damage. A wiring trough is located just below the operating mechanism across the front of the breaker. Open at both ends, it permits the installation of concealed wiring between adjacent breakers in the field.

One of the blast valves is shown in the open position, with the arrows indicating the flow of compressed air from the reservoir into the blast tube with the force needed for efficient arc interruption. Each valve is opened by the counter-clockwise movement of a cam on the main breaker jack shaft. This cam, acting through a set of rollers and levers, creates a force on the valve stem to open the valve.

Each valve is partially opened before the contacts separate, and then moves quickly to full open position; the cam action allows the spring and air pressure to close the valve before the contacts reach the full open position. A Neoprene valve seat, with a metal stop separate from the valve seat to restrain its deflection, produces a tight seal with long life. These blast valves do not operate on the closing operation of the breaker.

Double-acting tubular-type oil-filled shock absorbers in conjunction with compression springs operate off the jack shaft to cushion the motion of the contacts. Over-center action of the shock absorbers produces a deceleration of the shaft at the very end of the closing stroke after the contacts are almost completely closed, and over the latter part of the opening stroke after the arc has been extinguished. The compression springs also are double acting; they hold the contacts in the open and closed positions through a toggle.

operation



The illustration above shows the flow of compressed air through the breaker at the moment of contact separation. Operation of the trip coil (an instant earlier) has opened the air valve to admit air pressure to the top of the piston. Movement of the jack shaft has already opened the blast valves and released the flow of compressed air through the blast tubes directly into the arc path. This blast of air carries the arc and its gases upward into the arc chute. Here the arc is quickly extinguished and the arc gases are cooled as they enter the diffusion chamber.

When contact separation insures complete interruption, the blast valves close and the contacts are carried to the full open position as the piston comes to rest at the end of its stroke and pressure in the cylinder is released.

Closing action is obtained by the operation of an air valve to permit pressure on the bottom of the piston, which carries the contacts to the closed position. Contacting is accomplished with such high speed that air blasts are not required.

b operating mechanism compartment • *continued*

compressed air supply

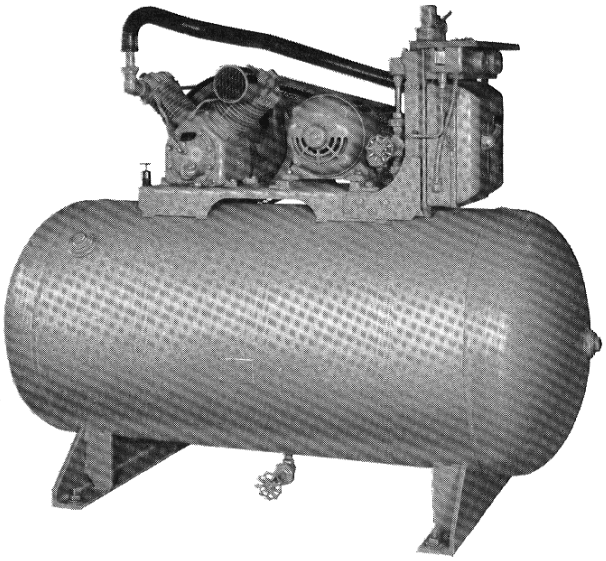
Since a compressor is not furnished as an integral part of each type CA breaker, a separate source of dry compressed air must be provided. The size and number of air supply units for each installation will depend upon the size and number of breakers.

Each air supply unit consists of a 27 cubic foot storage reservoir with one or two motor-driven compressors, cooling coils, pressure switches, pressure gauges, check valve, pressure reducing valve, protection valve, and outlet and drain valves.

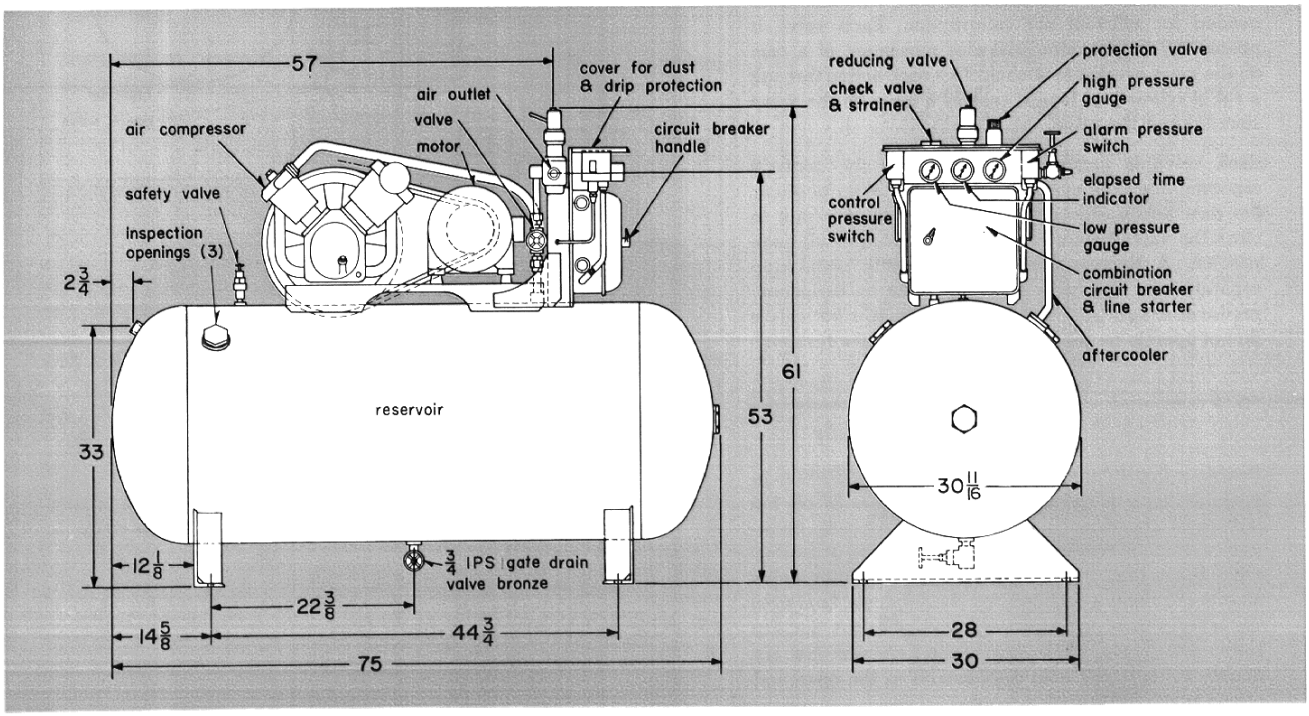
For installations of one or two breakers, one air supply unit with two small compressors and a single air storage reservoir is recommended. For larger installations, two or more air supply units, each with a larger size compressor unit, should be used. The smaller size compressor has a delivery of 4 cubic feet of free air per minute and the larger 7 cubic feet per minute.

Air in the storage reservoir is maintained at a pressure of 300 pounds per square inch. It passes through a pressure reducing valve to a pressure of 150 pounds per square inch before entering the circuit breaker storage reservoirs.

Air drying is obtained by compression to 300 psi, then cooling before expansion to the breaker operating pressure of 150 psi. This reduces the relative humidity. The moisture precipitated in the air supply unit reservoir may be removed through drain valves.

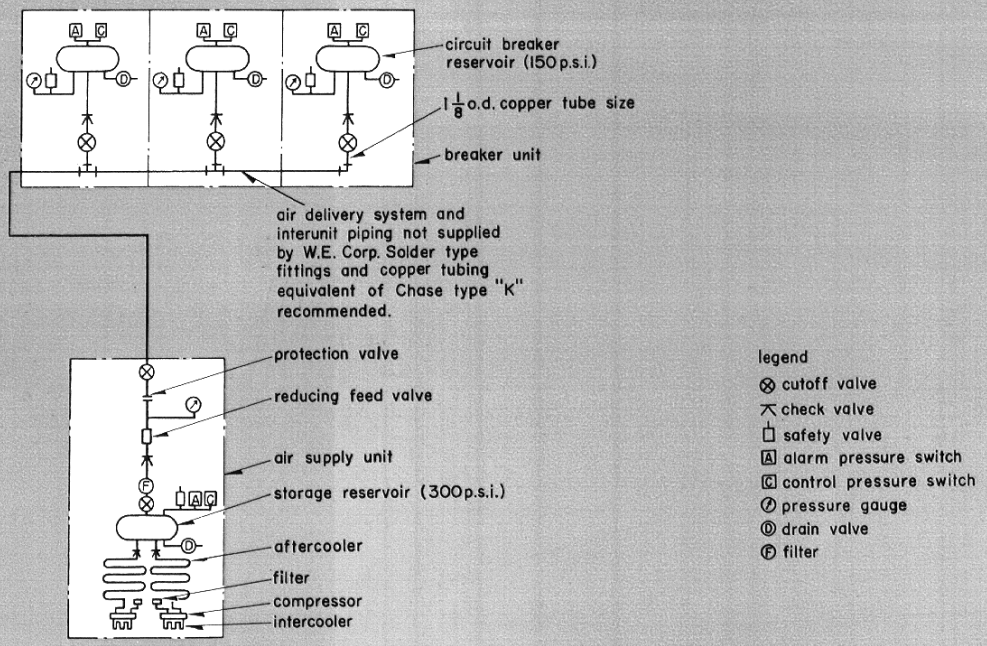


dimensions in inches

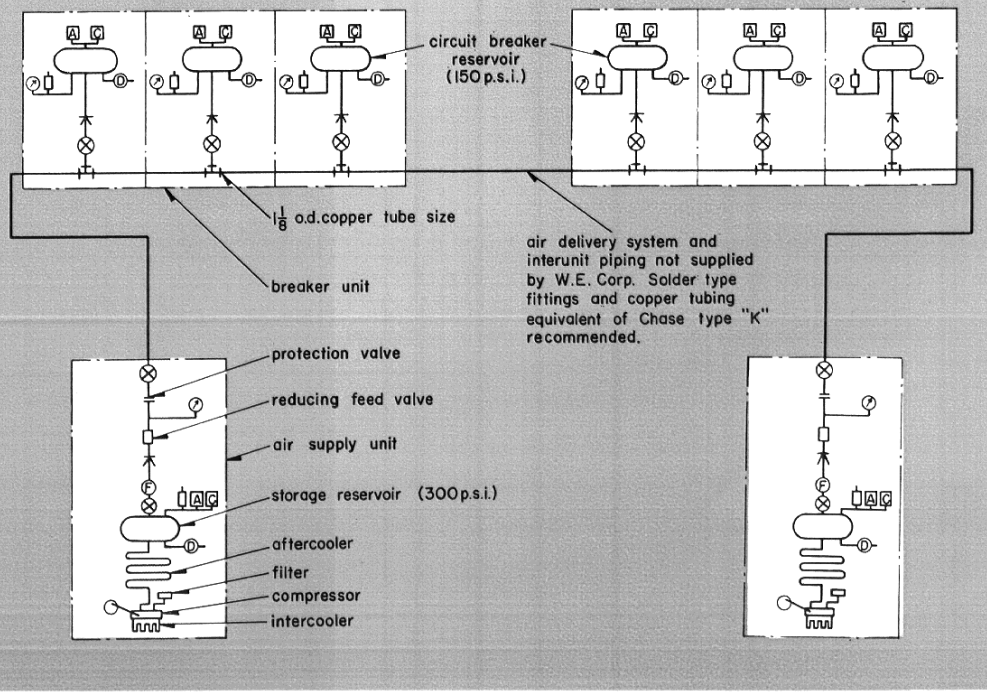


air supply systems

for small installations



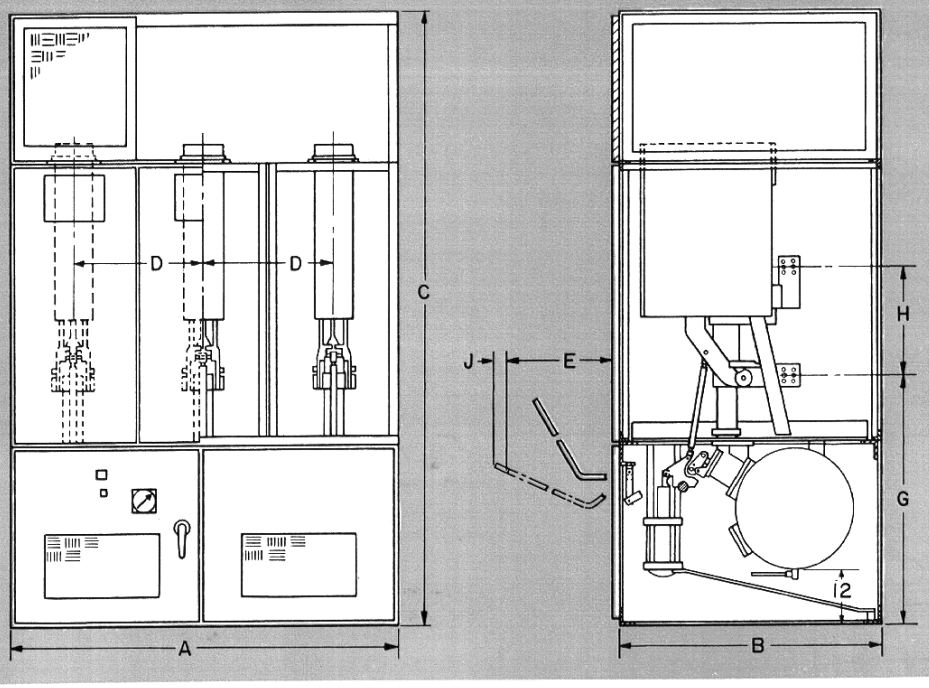
for large installations



compressed air breakers
type CA • indoor

dimensions and ratings

dimensions in inches



voltage rating	three-phase interrupting rating: mva	continuous current rating: amps	approximate dimensions: inches A	B	C	D	E	G	H	J	approx wt: lbs net	shipping
14.4 kv	1000	1200	62	53	130	20⅝	42	50	22½	3	4500	5300
	1000	3000	62	53	130	20⅝	42	50	22½	3	5000	5900
	1500	2000	62	53	130	20⅝	42	50	22½	3	4500	5300
	1500	4000	68	53	130	22⅝	42	50	22½	3	5500	6500
	2500	5000†	80	53	130	26⅝	42	50	22½	3	6000	7000
34.5 kv	1500	1200	102	57	143	34	42	67	32	3	8000	9500
	1500	3000	102	57	143	34	42	67	32	3	9000	10500
	2500	3000	108	57	143	36	42	67	32	3	10000	12000

† 6000 and 7000 amperes available with special provisions for blower cooling.

ratings

type	voltage ratings: rated kv	max. design kv	min. kv for rated mva	insulation level: withstand test, low frequency rms-kv	impulse crest kv	current rating in amperes: continuous 60-cycle	short time: momentary	four second	interrupting ratings: 3-phase rated mva	amperes at rated voltage	maximum amperes	time in cycles
150CA1000	14.4	15.5	12	50	110	1200	77000	48000	1000	40000	48000	8
150CA1000	14.4	15.5	12	50	110	3000	77000	48000	1000	40000	48000	8
150CA1500	14.4	15.5	12	50	110	2000	115000	72000	1500	60000	72000	8
150CA1500	14.4	15.5	12	50	110	4000	115000	72000	1500	60000	72000	8
150CA2500	14.4	15.5	12	50	110	5000	190000	120000	2500	100000	120000	8
150CA2500	14.4	15.5	12	50	110	6000	190000	120000	2500	100000	120000	8
150CA2500	14.4	15.5	12	50	110	7000	190000	120000	2500	100000	120000	8
345CA1500	34.5	38	23	80	200	1200	61000	38000	1500	25000	38000	8
345CA1500	34.5	38	23	80	200	3000	61000	38000	1500	25000	38000	8
345CA2500	34.5	38	24	80	200	3000	96000	60000	2500	42000	60000	8

further information

prices: price list 33-420
station-type cubicle switchgear: B. 5670
type CAF arc furnace compressed air breakers: descriptive bulletin 33-451

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