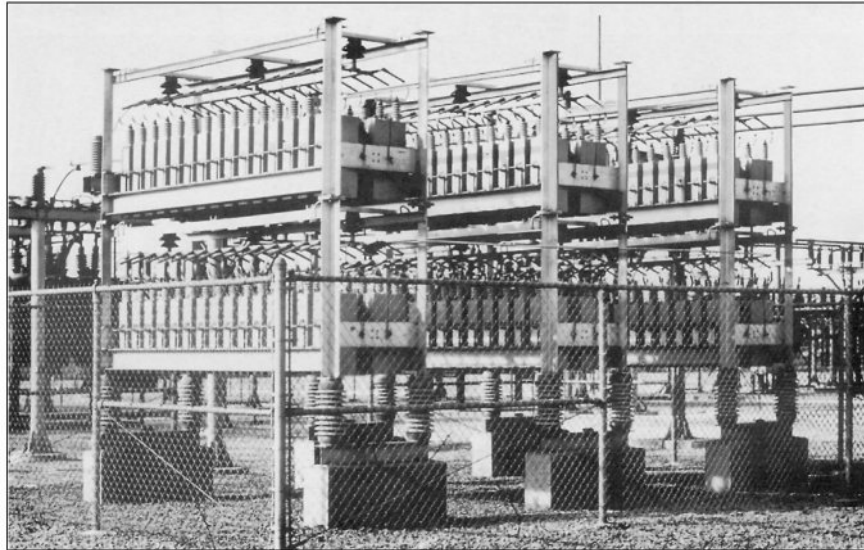


Block banks and accessories



Small or large Kvar requirements can be supplied, wherever the need exists, by Eaton's capacitor block banks, a Cooper Power™ series product. A complete capacitor block bank generally consists of:

- A number of block assemblies to provide desired Kvar
- Base and interblock insulators to provide desired BIL
- Interblock connection equipment
- Accessories or special features as required

Standard factory assembled blocks consist of distribution-class capacitors connected in parallel, series-parallel, or in a three-phase arrangement and mounted in a sturdy welded aluminum frame. The individual capacitor units are rated 100, 150, and 200 kvar, 2400 to 21600 volts, and at 75, 95, and 125 BIL. Blocks are also supplied with properly sized, bus-mounted, indicating-type fuses for individual capacitors.

The economical factory-assembled blocks provide Kvar requirements in a compact, adaptable, easy-to-install package that fits the needs of a growing system.

Numerous configurations of block sizes and bus arrangements are standard. This allows for fast, simple, yet precise, factory production which results in a lower overall cost without sacrificing quality.

Beyond a complete line of block banks and associated accessories, Eaton can offer more. For example, there is the convenience for the customer of a single point-of-contact from order placement onward throughout equipment service life. This helps to assure equipment that is properly applied and system compatible.

Low installed cost

- Reduced design engineering
- Reduced installation labor
- Reduced ordering, shipping, and handling time

Fast installation

- Blocks assembled and wired at factory
- Precision construction to simplify field installation

Application flexibility

- Banks enlarged or relocated easily as system demands change
- Large selection of block and bus arrangements

Complete line of accessories

- Complete line of accessories and engineering recommendations for application

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Construction features

Factory-assembled blocks with vertically and horizontally mounted capacitors

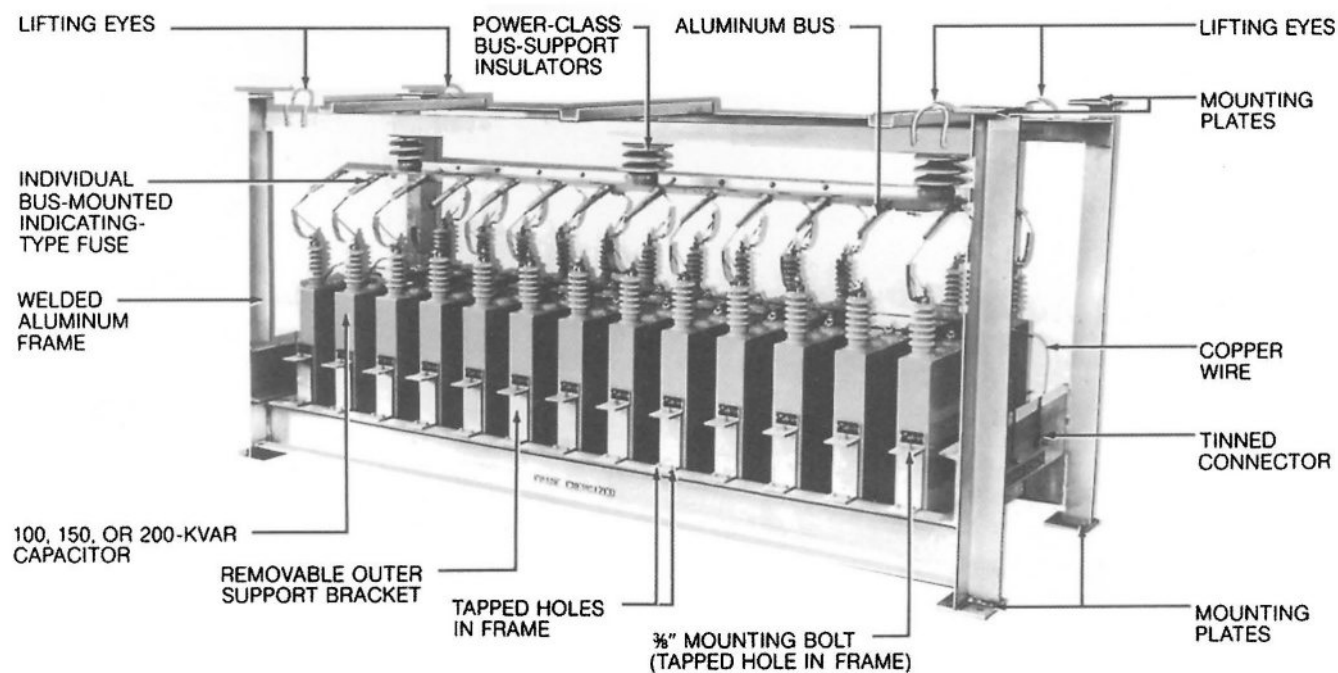


Figure 1. Factory-assembled block with vertically mounted capacitors.

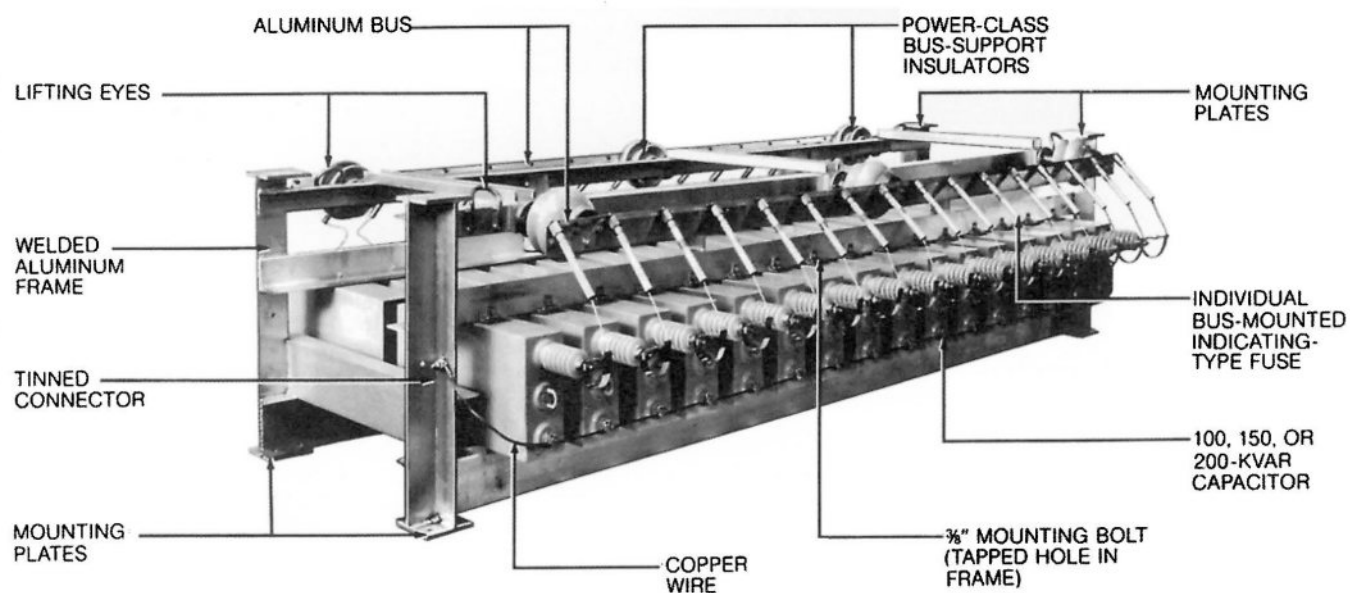


Figure 2. Factory-assembled block with horizontally mounted capacitors.

Dimensions and weights

Blocks with vertically mounted capacitors

(Applicable to 2.4-15 kV rated blocks only.)

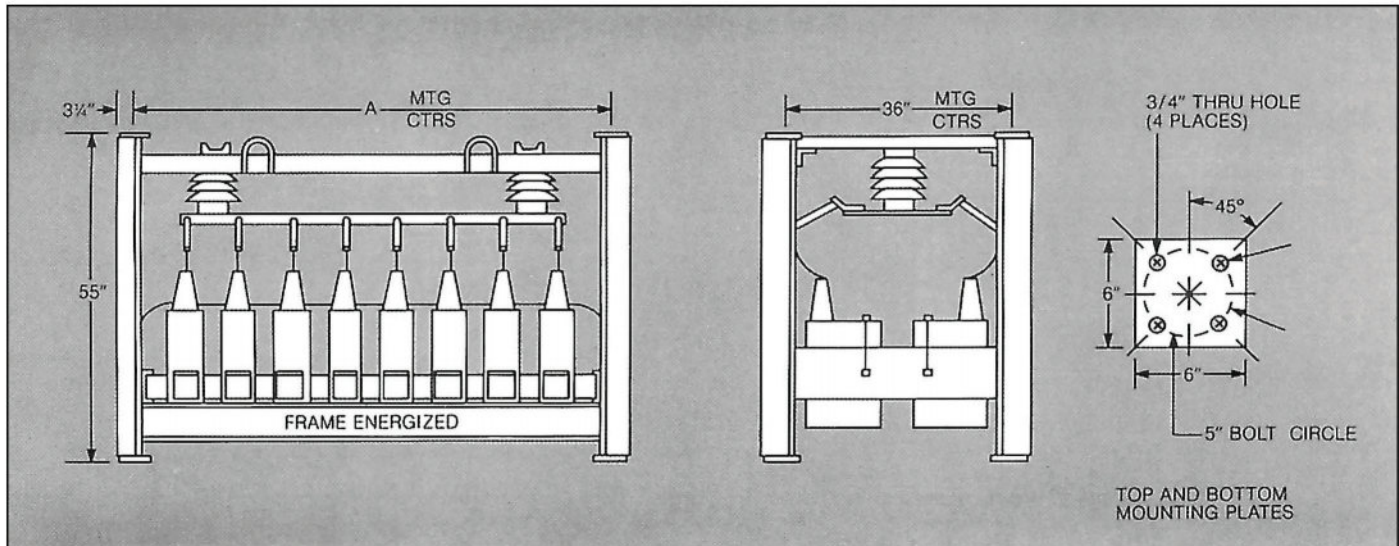


Figure 3. Dimensions for vertically mounted capacitor blocks.

Table 1. Dimensions and Weights for Vertically Mounted Capacitor Blocks

Number of Capacitors in Block	Dimension* A (inches)	Approximate Net Block and Kvar					
		100-Kvar Units		150-Kvar Units		200-Kvar Units	
		Wt (lb)	Kvar	Wt (lb)	Kvar	Wt (lb)	Kvar
8	40	670	800	860	1200	995	1600
10	48	790	1000	1030	1500	1200	2000
12	56	915	1200	1200	1800	1405	2400
14	64	1040	1400	1370	2100	1610	2800
16	72	1160	1600	1545	2400	1820	3200
18	80	1300	1800	1735	2700	2040	3600
20	88	1425	2000	1905	3000	2245	4000
22	96	1545	2200	2075	3300	2445	4400
24	104	1670	2400	2245	3600	2650	4800
26	112	1795	2600	2420	3900	2860	5200
28	120	1915	2800	2590	4200	3065	5600
30	128	2040	3000	2760	4500	3270	6000
32	136	2160	3200	2930	4800	3475	6400
34	144	2280	3400	3100	5100	3675	6800
36	152	2425	3600	3290	5400	3900	7200

*Dimensions and weights are typical of 2.4 to 7.96 kV blocks with units connected in parallel. Dimensions and weights increase slightly for higher voltages.

Blocks with horizontally mounted capacitors

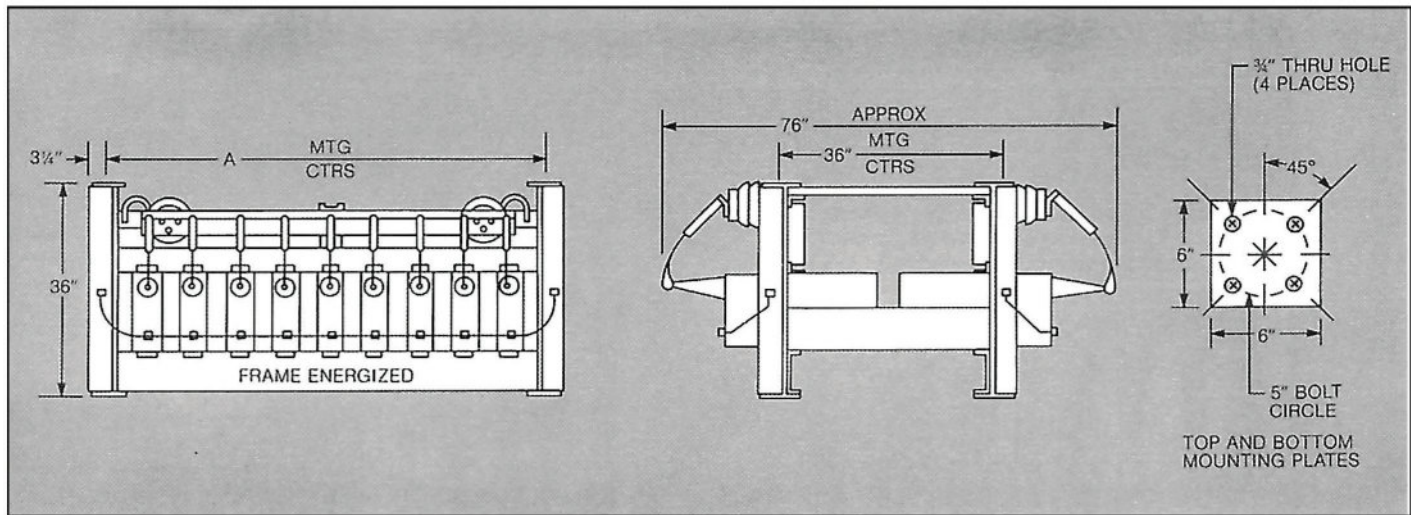


Figure 4. Dimensions for horizontally mounted capacitor blocks.

Table 2. Dimensions and Weights for Horizontally Mounted Capacitor Blocks

Number of Capacitors in Block	Dimension* A (inches)	Approximate Net Block and Kvar					
		100-Kvar Units		150-Kvar Units		200-Kvar Units	
		Wt (lb)	Kvar	Wt (lb)	Kvar	Wt (lb)	Kvar
8	32	645	800	840	1200	975	1600
10	40	770	1000	1010	1500	1175	2000
12	48	890	1200	1175	1800	1380	2400
14	56	1010	1400	1345	2100	1585	2800
16	64	1140	1600	1520	2400	1795	3200
18	72	1260	1800	1690	2700	1995	3600
20	80	1415	2000	1895	3000	2235	4000
22	88	1535	2200	2060	3300	2435	4400
24	96	1655	2400	2230	3600	2640	4800
26	104	1780	2600	2405	3900	2850	5200
28	112	1905	2800	2575	4200	3050	5600
30	120	2015	3000	2735	4500	3245	6000
32	128	2135	3200	2905	4800	3450	6400
34	136	2260	3400	3075	5100	3650	6800
36	144	2430	3600	3290	5400	3905	7200

*Dimensions and weights are typical of 2.4 to 7.96 kV blocks with units connected in parallel. Dimensions and weights increase slightly for higher voltages.

Standard fusing and accessories

Bus-mounted expulsion type capacitor fuses are standard equipment

Faulted capacitors are quickly removed from circuits with bus-mounted fuses furnished on factory-assembled capacitor blocks.

A noncurrent-carrying, stainless steel flipper ejects the fuse leader from its tube when the link melts. Voltage stress across the fuse tube is eliminated by the resulting air gap between the end of the fuse tube and the capacitor terminal. There is no possibility of tracking and eventual flashover, even after exposure to weather and contaminants. Positive indication of a blown fuse can easily be detected, close up or from a distance, by the flipper's horizontal position.

Capacitor block accessories

The following accessories can be provided with capacitor blocks:

- Automatic switching controls
- Isolating or grounding switches
- Current-limiting fuses
- Oil switches, vacuum switches, or circuit breakers
- Interlocks
- Line disconnect switches
- Spacing and base-support insulators
- Single-or multiple-bus arrangement
- Block shorting switch
- Elevating structure
- Mounting frame for switches
- Hoist assembly for switches
- Inrush current-limiting reactors
- Unbalance protection schemes

Block shorting switch

To assure maintenance personnel safety while working on or around capacitor banks, Eaton offers the FW14Y1 block shorting switch. The switch, a single-pole, hookstick-operated blade switch that mounts on the capacitor block frame, provides visual indication and removes any doubt that capacitors are fully discharged.

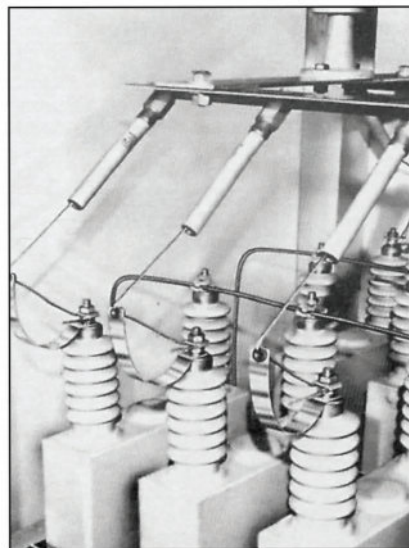


Figure 5. Block shorting switch.

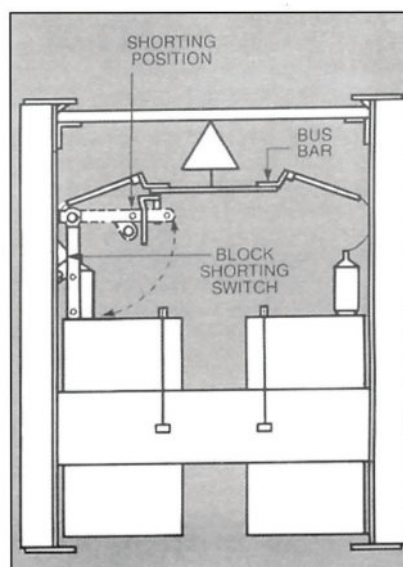


Figure 6. Expulsion fuses mounted on capacitor block.

Table 3.

Capacitor Voltage	Block Mounting Construction		Current Rating (amps)	Joule Rating	Interrupting Rating Symmetric/ (amps)
	Catalog Number (Vertical)	Catalog Number (Horizontal)			
2400-7960	FN10B5	FN13B3	50	15,000	5000/3600
8000-14,400	FN11B1	FN14B1	50	15,000	5000/3600
15,000-23,000	FN11B1	FN14B1	15	15,000	2500/1800

Bus-mounted current-limiting type capacitor fuses

The NXC® capacitor fuse is a current-limiting, non-expulsion, full-range clearing device. The fuse has an automatic leader ejection feature which provides positive interruption and capacitor isolation. It will interrupt at least 50,000 symmetrical amperes.

The NXC fuse is particularly applicable for fusing units where the stored energy exceeds the joule capability of the capacitor. The joule capability of Eaton's capacitors ranges from 10 to 15 kilojoules.

Elevating structure assembly

For equipment protection and personnel safety, an aluminum elevating structure assembly is available to provide a raised installation for factory-assembled capacitor blocks. The structure will also support additional aluminum framework for mounting switches, controls, and insulators.

Bottom and top plates of the elevating structure match to assure perfect alignment. Bottom plates of the structure are coated with asphalt paint for mounting on concrete footings. The structure is shipped partially unassembled. The only field assembly required is bolting the cross braces to the two welded end sections.

Oil switches

Refer to *Catalog Data CA230070EN Electrically Operated Type NR Oil Switch* for further information.

Table 4. Catalog Numbers

Catalog Number	Voltage (kV)	Continuous Current (amps)*	Interrupting Symmetrical (amps)
FA5J10	8.3	10C	50,000
FA5J18		18C	
FA5J25		25C	
FA5J30		30C	
FA5J40		40C	
FA5J45		45C	
FA6J10	15.5	10C	50,000
FA6J12		12C	
FA6J18		18C	
FA6J25		25C	
FA6J30		30C	
FA7J8	23	8C	50,000
FA7J10		10C	
FA7J12		12C	
FA7J18		18C	

* Letter C after current rating denotes conformance to ANSI® C37.47-1969 classification C requirements.

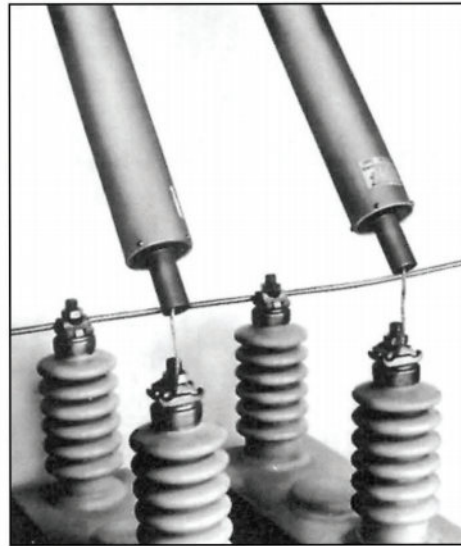


Figure 7. NXC fuses mounted on capacitor block.

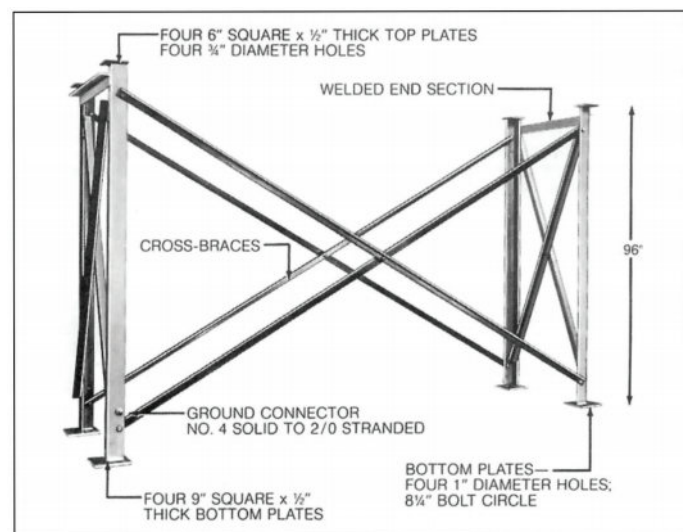


Figure 8. Elevating structure.

Inrush current-limiting reactors

Eaton inrush current-limiting reactors limit transient discharge currents during switching of parallel steps in closely spaced capacitor banks. The fully tested design assures proper protection for switching equipment. Inductance selected will limit inrush current to safe levels in most banks, thus preventing switchgear damage.

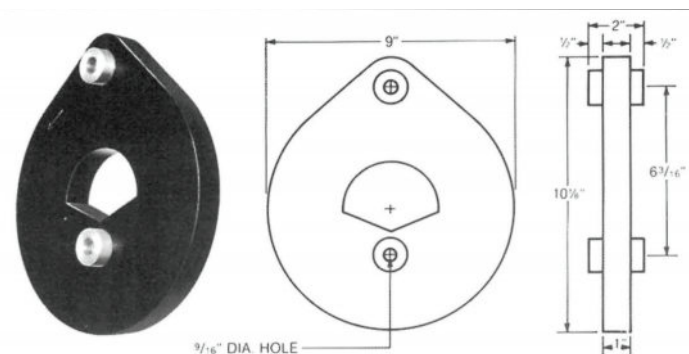


Figure 9. Current-limiting reactor CM13B1.

Table 5.

Inductance* (uh)	No. Units in Parallel	Maximum Continuous Current Rating (amps)		High Frequency Rating	
		60 Hertz**	1/2 Cycle 60 Hz rms asym	Max. Inrush Current (kA)	Max. Surge Voltage (kV)
40	1	135	9000	12	18
28	2	235	9000	12	18
21	3	300	12000	12	18

* When mounted vertically with 1-inch spacing and the same winding direction for parallel units.

** When mounted vertically with 1-inch spacing between parallel units.

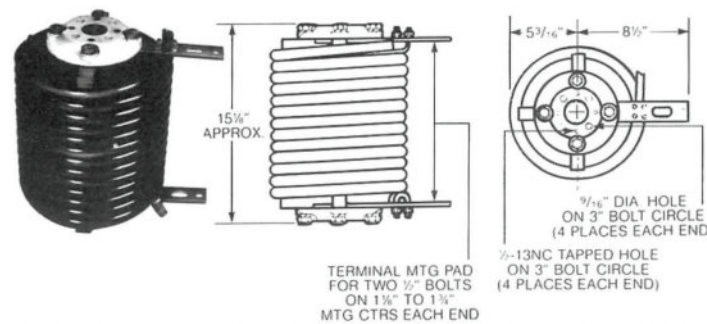


Figure 10. Current-limiting reactor CM13B1.

Table 6.

Inductance* (uh)	Maximum Continuous Current Rating (amps)		Max. Inrush Current (peak amps)	Max. Surge Voltage (peak kV)
	60 Hz rms	1/2 Cycle 60 Hz rms asym		
20	400	30,000	45,000	75

Mounting frame and hoist assembly for oil switches

A special CB38M1 mounting frame attachment is available to cradle oil switches on aluminum elevating structures. The mounting frame has provisions for mounting three bus insulators.

If required, CB40M1 switch hoist assembly can be attached to raise and lower the oil switch for periodic maintenance and inspection. The frame and hoist assembly are shipped dismantled, with all necessary assembly hardware. The above accessories apply to Type VR and VCR oil switches. Similar frames for Type TSC oil switch and vacuum switches are also available. See *Catalog Data CA230007EN, Electrically Operated Type NR Oil Switch*.

Neutral unbalance protection equipment

The use of Eaton's neutral unbalance protection equipment is considered desirable and is practical in most applications. Eaton has four basic unbalance protection methods for capacitor banks in all standard voltages from 15 kV through 161 kV. The four methods are:

1. Double-wye, split-neutral bank method
2. Grounded neutral bank method
3. Ungrounded neutral bank method with potential transformer sensing
4. Ungrounded neutral bank method with capacitor network sensing (Eaton patent). Each of these methods has its own special advantages depending upon the particular application. All circuits provide continuous monitoring and will trip out the capacitor bank when established tolerances have been exceeded.

The general categories of protection provided by unbalance detection are:

1. Protection against major faults within the bank
2. Protection against sustained unbalance neutral conditions
3. Protection against overvoltage conditions

Ordering information

When ordering capacitor blocks, or when requesting proposals, specify:

1. Voltage
 - A. Nominal voltage at which bank will be operated
 - B. System BIL
2. Kvar
 - A. Desired total three-phase Kvar
3. Capacitors
 - A. Special requirements, if any, such as preferred voltage rating, Kvar rating, two-bushing capacitors (single-bushing units are standard) or extra-creepage bushings
4. Bank Construction
 - A. Elevated or non-elevated (eight foot structure is standard)
 - B. Limiting dimensions, if any, in bank height, width, or length
 - C. Connection – grounded wye, ungrounded wye, or delta
 - D. Unbalance protection required
 - E. Vertical or horizontal mounting of capacitor units
5. Available Fault Current at Bank
6. Type of Duty Expected
 - A. Isolated or paralleled bank. (If paralleled, how many other banks, what Kvar sizes, how close?)
 - B. Expected number of switching operations daily
7. Desired Accessory Equipment. (Refer to accessories listed on page 5.)
8. Any unusual environmental conditions expected

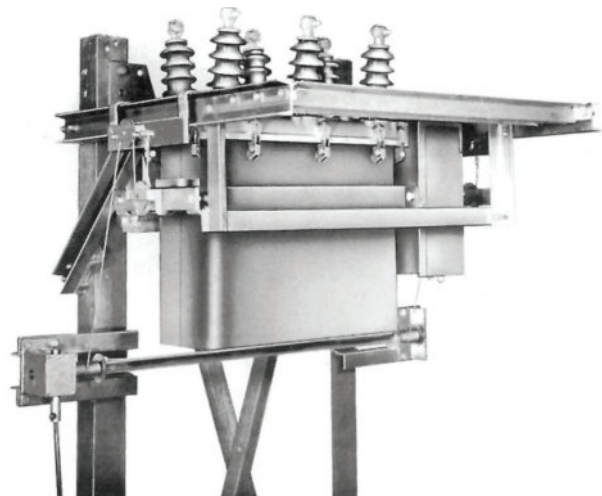


Figure 11. Mounting frame and hoist assembly.

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