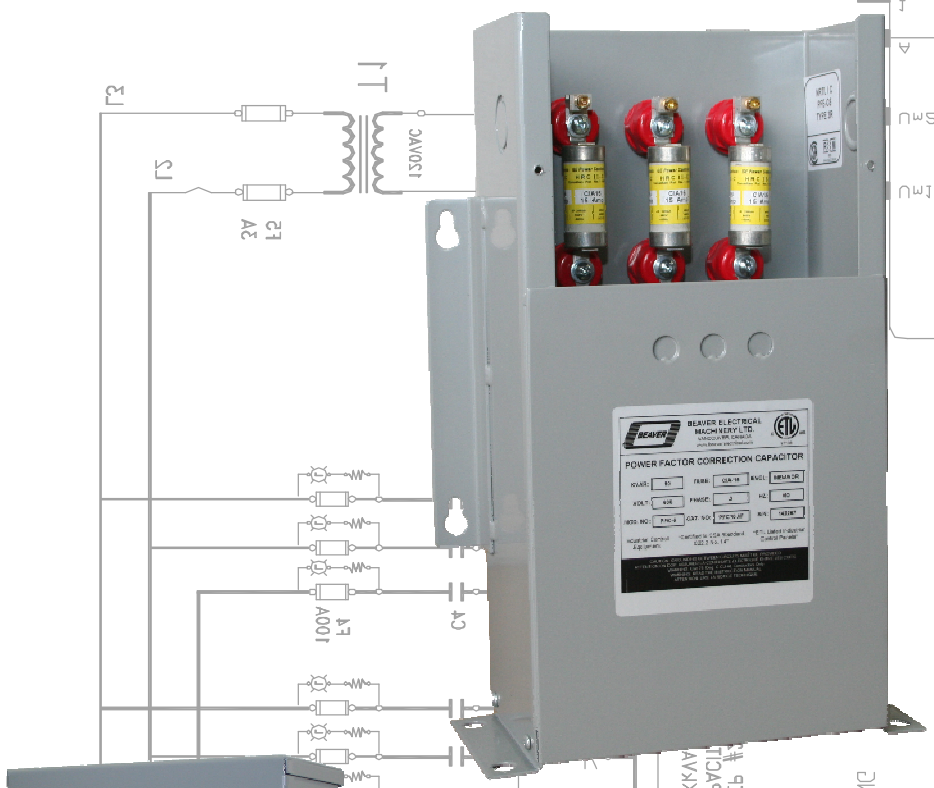
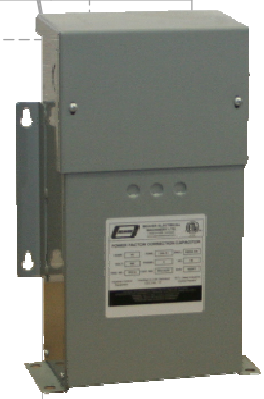
Beaver Power Factor Correction Capacitors





BEAVER

Beaver Low Voltage Power Factor Correction Capacitors are designed for long life and are made with the highest quality materials. All units are assembled in Canada and built to meet CSA standards.

Applications
Individual motor loads
Motor control centres
Distribution networks

Ratings
600, 480 240 and 208 volt
Three phase
60 Hertz

Interrupting rating
Standard fused - 100kAIR
Non-fused - 10kAIR

Options
Capacitor status indicators
Blown fuse indicators
Contactors
Timers
Non-fused units
4/12 and 4X enclosures

Also available
415, 400, or 380 volt
50 Hz
Single phase
Non-standard kVAR ratings
Automatic systems

Features
Enclosure
Heavy #16 gauge steel
Powder coated ASA 61 finish
Wall and floor mount C1 through C6
Floor mount C10
½" and ¾" knockouts
CSA type 3R rated

Cover
"L" shaped for easy access
Front access screws
Gasketed

Ground terminal
CSA AL9CU 2-14

Line terminals
Suitable for copper or aluminum
Oversized

Fusing
Up to 200 amps; HRC Class C
Over 200 amps; BS88

Operating temperature
- 40° C to + 40° C

Three phase dry type capacitor cells
Terminals
Threaded connection
10 kVAC stand-off terminal
30 kV BIL

Dielectric fill
Thermosetting polymer resin
No fluids, No PCBs
Flash point + 212° C
Fire point + 260° C

Dielectric film
Self healing metalized polypropylene

Pressure sensitive interrupter
Three phase internal

Discharge resistors
Reduce residual voltage to less than 50 volts within one minute of de-energization

Losses
Less then ½ watt per kVAR

Warranty
One year

Part numbering system

KVB 30 T / F E4

Series kVAR Voltage Options Enclosure

Series	KVB	Three phase capacitor	Options	F	Fused
				B	Blown fuse indicators
kVAR	0.5-200	kVAR rating		S	Single phase
Voltage	H	208		H	Harmonic cells
	K	240		C	Contactor
	P	380		T	Timer
	Q	400		G	Capacitor status indicator
	R	415		X	Special feature
	S	480	Enclosure	*Blank*	CSA 3R Outdoor
	T	600		E4	CSA 4/12 Watertight/Dust-tight
Frequency	*Blank*	60 Hz		E4X	CSA 4X Watertight stainless steel
	50	50 Hz			

Power Factor Correction Table

Orig. PF	Corrected Power Factor																				
	0.80	0.81	0.82	0.83	0.84	0.85	0.86	0.87	0.88	0.89	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00
0.50	0.982	1.008	1.034	1.060	1.086	1.112	1.139	1.165	1.192	1.220	1.248	1.276	1.306	1.337	1.369	1.403	1.440	1.481	1.529	1.590	1.732
0.51	0.937	0.963	0.989	1.015	1.041	1.067	1.093	1.120	1.147	1.174	1.202	1.231	1.261	1.291	1.324	1.358	1.395	1.436	1.484	1.544	1.687
0.52	0.893	0.919	0.945	0.971	0.997	1.023	1.049	1.076	1.103	1.130	1.158	1.187	1.217	1.247	1.280	1.314	1.351	1.392	1.440	1.500	1.643
0.53	0.850	0.876	0.902	0.928	0.954	0.980	1.007	1.033	1.060	1.088	1.116	1.144	1.174	1.205	1.237	1.271	1.308	1.349	1.397	1.458	1.600
0.54	0.809	0.835	0.861	0.887	0.913	0.939	0.965	0.992	1.019	1.046	1.074	1.103	1.133	1.163	1.196	1.230	1.267	1.308	1.356	1.416	1.559
0.55	0.768	0.794	0.820	0.846	0.873	0.899	0.925	0.952	0.979	1.006	1.034	1.063	1.092	1.123	1.156	1.190	1.227	1.268	1.315	1.376	1.518
0.56	0.729	0.755	0.781	0.807	0.834	0.860	0.886	0.913	0.940	0.967	0.995	1.024	1.053	1.084	1.116	1.151	1.188	1.229	1.276	1.337	1.479
0.57	0.691	0.717	0.743	0.769	0.796	0.822	0.848	0.875	0.902	0.929	0.957	0.986	1.015	1.046	1.079	1.113	1.150	1.191	1.238	1.299	1.441
0.58	0.655	0.681	0.707	0.733	0.759	0.785	0.811	0.838	0.865	0.892	0.920	0.949	0.979	1.009	1.042	1.076	1.113	1.154	1.201	1.262	1.405
0.59	0.618	0.644	0.670	0.696	0.723	0.749	0.775	0.802	0.829	0.856	0.884	0.913	0.942	0.973	1.006	1.040	1.077	1.118	1.165	1.226	1.368
0.60	0.583	0.609	0.635	0.661	0.687	0.714	0.740	0.767	0.794	0.821	0.849	0.878	0.907	0.938	0.970	1.005	1.042	1.083	1.130	1.191	1.333
0.61	0.549	0.575	0.601	0.627	0.653	0.679	0.706	0.732	0.759	0.787	0.815	0.843	0.873	0.904	0.936	0.970	1.007	1.048	1.096	1.157	1.299
0.62	0.515	0.541	0.567	0.593	0.620	0.646	0.672	0.699	0.726	0.753	0.781	0.810	0.839	0.870	0.903	0.937	0.974	1.015	1.062	1.123	1.265
0.63	0.483	0.509	0.535	0.561	0.587	0.613	0.639	0.666	0.693	0.720	0.748	0.777	0.807	0.837	0.870	0.904	0.941	0.982	1.030	1.090	1.233
0.64	0.451	0.477	0.503	0.529	0.555	0.581	0.607	0.634	0.661	0.688	0.716	0.745	0.775	0.805	0.838	0.872	0.909	0.950	0.998	1.058	1.201
0.65	0.419	0.445	0.471	0.497	0.523	0.549	0.576	0.602	0.629	0.657	0.685	0.714	0.743	0.774	0.806	0.840	0.877	0.919	0.966	1.027	1.169
0.66	0.388	0.414	0.440	0.466	0.492	0.519	0.545	0.572	0.599	0.626	0.654	0.683	0.712	0.743	0.775	0.810	0.847	0.888	0.935	0.996	1.138
0.67	0.358	0.384	0.410	0.436	0.462	0.488	0.515	0.541	0.568	0.596	0.624	0.652	0.682	0.713	0.745	0.779	0.816	0.857	0.905	0.966	1.108
0.68	0.328	0.354	0.380	0.406	0.432	0.459	0.485	0.512	0.539	0.566	0.594	0.623	0.652	0.683	0.715	0.750	0.787	0.828	0.875	0.936	1.078
0.69	0.299	0.325	0.351	0.377	0.403	0.429	0.456	0.482	0.509	0.537	0.565	0.593	0.623	0.654	0.686	0.720	0.757	0.798	0.846	0.907	1.049
0.70	0.270	0.296	0.322	0.348	0.374	0.400	0.427	0.453	0.480	0.508	0.536	0.565	0.594	0.625	0.657	0.692	0.729	0.770	0.817	0.878	1.020
0.71	0.242	0.268	0.294	0.320	0.346	0.372	0.398	0.425	0.452	0.480	0.508	0.536	0.566	0.597	0.629	0.663	0.700	0.741	0.789	0.849	0.992
0.72	0.214	0.240	0.266	0.292	0.318	0.344	0.370	0.397	0.424	0.452	0.480	0.508	0.538	0.569	0.601	0.635	0.672	0.713	0.761	0.821	0.964
0.73	0.186	0.212	0.238	0.264	0.290	0.316	0.343	0.370	0.396	0.424	0.452	0.481	0.510	0.541	0.573	0.608	0.645	0.686	0.733	0.794	0.936
0.74	0.159	0.185	0.211	0.237	0.263	0.289	0.316	0.342	0.369	0.397	0.425	0.453	0.483	0.514	0.546	0.580	0.617	0.658	0.706	0.766	0.909
0.75	0.132	0.158	0.184	0.210	0.236	0.262	0.289	0.315	0.342	0.370	0.398	0.426	0.456	0.487	0.519	0.553	0.590	0.631	0.679	0.739	0.882
0.76	0.105	0.131	0.157	0.183	0.209	0.235	0.262	0.288	0.315	0.343	0.371	0.400	0.429	0.460	0.492	0.526	0.563	0.605	0.652	0.713	0.855
0.77	0.079	0.105	0.131	0.157	0.183	0.209	0.235	0.262	0.289	0.316	0.344	0.373	0.403	0.433	0.466	0.500	0.537	0.578	0.626	0.686	0.829
0.78	0.052	0.078	0.104	0.130	0.156	0.183	0.209	0.236	0.263	0.290	0.318	0.347	0.376	0.407	0.439	0.474	0.511	0.552	0.599	0.660	0.802
0.79	0.026	0.052	0.078	0.104	0.130	0.156	0.183	0.209	0.236	0.264	0.292	0.320	0.350	0.381	0.413	0.447	0.484	0.525	0.573	0.634	0.776
0.80	0.000	0.026	0.052	0.078	0.104	0.130	0.157	0.183	0.210	0.238	0.266	0.294	0.324	0.355	0.387	0.421	0.458	0.499	0.547	0.608	0.750
0.81		0.000	0.026	0.052	0.078	0.104	0.131	0.157	0.184	0.212	0.240	0.268	0.298	0.329	0.361	0.395	0.432	0.473	0.521	0.581	0.724
0.82			0.000	0.026	0.052	0.078	0.105	0.131	0.158	0.186	0.214	0.242	0.272	0.303	0.335	0.369	0.406	0.447	0.495	0.556	0.698
0.83				0.000	0.026	0.052	0.079	0.105	0.132	0.160	0.188	0.216	0.246	0.277	0.309	0.343	0.380	0.421	0.469	0.530	0.672
0.84					0.000	0.026	0.053	0.079	0.106	0.134	0.162	0.190	0.220	0.251	0.283	0.317	0.354	0.395	0.443	0.503	0.646
0.85						0.000	0.026	0.053	0.080	0.107	0.135	0.164	0.194	0.225	0.257	0.291	0.328	0.369	0.417	0.477	0.620
0.86							0.000	0.027	0.054	0.081	0.109	0.138	0.167	0.198	0.230	0.265	0.302	0.343	0.390	0.451	0.593
0.87								0.000	0.027	0.054	0.082	0.111	0.141	0.172	0.204	0.238	0.275	0.316	0.364	0.424	0.567
0.88									0.000	0.027	0.055	0.084	0.114	0.145	0.177	0.211	0.248	0.289	0.337	0.397	0.540
0.89										0.000	0.028	0.057	0.086	0.117	0.149	0.184	0.221	0.262	0.309	0.370	0.512
0.90											0.000	0.029	0.058	0.089	0.121	0.156	0.193	0.234	0.281	0.342	0.484
0.91												0.000	0.030	0.060	0.093	0.127	0.164	0.205	0.253	0.313	0.456
0.92													0.000	0.031	0.063	0.097	0.134	0.175	0.223	0.284	0.426
0.93														0.000	0.032	0.067	0.104	0.145	0.192	0.253	0.395
0.94															0.000	0.034	0.071	0.112	0.160	0.220	0.363
0.95																0.000	0.037	0.078	0.126	0.186	0.329
0.96																	0.000	0.041	0.089	0.149	0.292
0.97																		0.000	0.048	0.108	0.251
0.98																			0.000	0.061	0.203
0.99																				0.000	0.142

Instructions:

1. Find the present power factor in "Orig. PF."
2. Read across to the desired Corrected PF column.
3. Multiply that number by kW demand.
4. Round to nearest capacitor size.

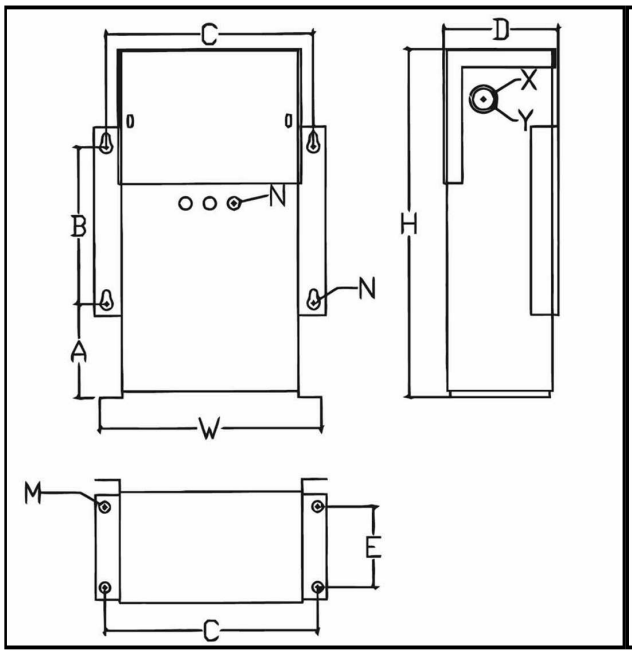
Example: If the present demand is 262 kW and was operating at 82% PF and the desired PF is 95%, you would:

1. Find 0.82 in the "Orig. PF" column.
2. Read across to the 0.95 Corrected PF column.
3. 0.369x262=96.7 kVAR which rounds to 100 kVAR.

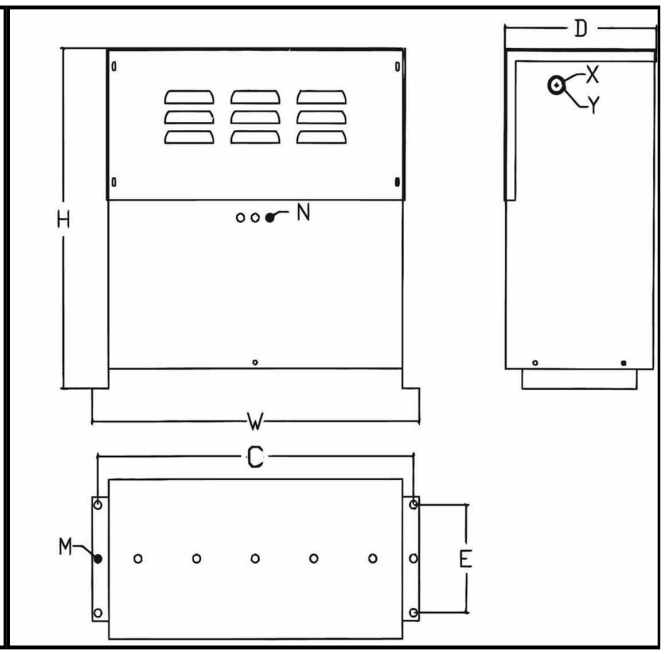
Beaver's engineering team can help with calculations. Please have 3-12 months of Hydro bills or detailed motor data available.

Enclosure Dimensions

Size C1S - C6



Size C10



SIZE CODE	CELLS	H	D	W	C	E	B	A	M	N	X	Y
C1	1	13.31	4.748	10.0	9.0	2.75	3.984	6.141	Ø 0.437	Ø 0.5	Ø 0.875	Ø 1.125
C2	2	20.325	5.906	11.4	10.4	3.25	5.875	8.375	Ø 0.437	Ø 0.5	Ø 0.875	Ø 1.125
C3	3	22.325	5.906	15.41	14.41	3.25	5.875	8.375	Ø 0.437	Ø 0.5	Ø 0.875	Ø 1.125
C4	4	22.5	9.406	11.375	10.375	7.25	5.875	7.718	Ø 0.437	Ø 0.5	Ø 0.875	Ø 1.125
C6	6	24.325	10.625	14.91	14.125	6.75	5.875	10.375	Ø 0.437	Ø 0.5	Ø 0.875	Ø 1.125
C10	10	22.0	5.531	15.594	14.536	3.25			Ø 0.437	Ø 0.5	Ø 0.875	Ø 1.125

208 Volt		480 Volt		600 Volt	
kVAR	Size Code	kVAR	Size Code	kVAR	Size Code
0 - 6	C1	0 - 15	C1	0 - 20	C1
7.5 - 15	C2	17.5 - 50	C2	22.5 - 50	C2
18.75 - 22.5	C3	55 - 75	C3	55 - 75	C3
24 - 30	C4	80 - 100	C4	80 - 100	C4
32 - 37.5	C6	105 - 120	C6	105 - 150	C6
40 - 75	C10	125 - 160	C10	155 - 200	C10

All specifications subject to change without notice.
Contact Beaver to confirm exact dimensions in critical applications.

Amperage, Fusing, and Weight

208 Volt				240 Volt				480 Volt				600 Volt			
kVAR	Rated Current (amps)	Fuse (amps)	Weight (pounds)	kVAR	Rated Current (amps)	Fuse (amps)	Weight (pounds)	kVAR	Rated Current (amps)	Fuse (amps)	Weight (pounds)	kVAR	Rated Current (amps)	Fuse (amps)	Weight (pounds)
0.38	1	2.25	13	0.5	1.2	3	13	1	1.2	3	12	2	1.9	4	13
0.75	2.1	4.5	13	1	2.4	5	13	2	2.4	5	12	2.5	2.4	5	13
1.13	3.1	7	15	1.5	3.6	8	15	2.5	3.0	6	12	5	4.8	10	14
1.5	4.2	9	15	2	4.8	10	15	4	4.8	10	13	7.5	7.2	15	14
1.88	5.2	12	16	2.5	6.0	15	16	5	6.0	12	14	10	9.6	20	14
2.25	6.2	15	16	3	7.2	15	16	6	7.2	15	14	12.5	12.0	25	17
3	8.3	17.5	16	4	9.6	20	17	7.5	9.0	20	14	15	14.4	30	18
3.75	10	25	17	5	12.1	25	17	8	9.6	20	14	17.5	16.8	35	19
4.69	13	30	17	6.25	15.1	35	19	10	12.0	25	14	20	19.2	40	19
5.63	15	35	19	7.5	18.1	40	19	12.5	15.0	30	17	25	24.0	50	25
6.25	17	40	19	8.33	20	45	21	15	18.0	40	18	30	28.8	60	26
7.5	21	45	19	10	24	50	24	17.5	21.0	45	19	35	33.6	70	28
9	25	60	24	12	29	60	28	20	24.0	50	19	40	38.4	80	30
11.25	31	70	28	15	36	80	32	25	30.0	60	25	45	43.2	90	32
13.13	36	80	32	17.5	42	90	34	30	36.0	80	26	50	48.0	100	35
15	42	90	32	20	48	100	41	35	42.0	90	28	55	52.8	110	36
18.75	52	110	41	25	60	125	42	40	48.0	100	30	60	57.6	125	37
20.63	57	125	42	27.5	66	150	46	45	54.0	110	32	65	62.4	125	39
22.5	62	150	42	30	72	150	50	50	60.0	125	35	70	67.2	150	42
24	66	150	42	32	77	175	52	55	66.0	150	36	75	72.0	150	45
27	75	175	46	36	87	175	52	60	72.0	150	37	80	76.8	175	47
28.13	78	175	50	37.5	90	200	54	65	78.0	175	39	90	86.4	175	52
30	83	175	52	40	96	200	64	70	84.0	175	42	100	96.0	200	54
31.88	88	200	52	42.5	102	225	64	75	90.0	200	45	120	115.2	250	57
34.5	96	200	52	46	111	225	67	80	96.0	200	47	125	120.0	250	72
36	100	225	52	48	116	250	35	90	108.0	225	52	140	134.4	300	74
37.5	104	225	54	50	121	250	70	100	120.0	250	54	150	144.0	300	76
41.25	114	250	64	55	133	300	72	120	144.0	300	57	160	153.6	350	77
45	125	300	67	60	145	300	73	125	150.0	300	72	180	172.8	400	79
48.75	135	300	70	65	157	350	75	140	168.0	350	74	200	192.0	400	85
52.5	150	300	72	70	169	350	77	150	180.0	400	76				
54	150	350	72	72	174	350	78	160	192.0	400	77				
56.25	156	350	73	75	181	400	79								
60	166	400	73	80	193	400	85								

All specifications subject to change without notice
208v units are derated 240v units.

Suggested maximum capacitor ratings

HP	3600 RPM		1800 PRM		1200 RPM	
	Capacitor kVAR	Current Reduction %	Capacitor kVAR	Current Reduction %	Capacitor kVAR	Current Reduction %
3	1.5	14	1.5	15	1.5	20
5	2	12	2	13	2	17
7.5	2.5	11	2.5	12	3	15
10	3	10	3	11	3	14
15	4	9	4	10	5	13
20	5	9	5	10	6	12
25	6	9	6	10	7.5	11
30	7	8	7	9	9	11
40	9	8	9	9	10	10
50	12.5	8	10	9	12.5	10
60	15	8	15	8	15	10
75	17.5	8	17.5	8	17.5	10
100	22.5	8	20	8	25	9
125	27.5	8	25	8	30	9
150	30	8	30	8	35	9
200	40	8	37.5	8	40	9
250	50	8	45	7	50	8
300	60	8	50	7	60	8
350	60	8	60	7	75	8
400	75	8	60	6	75	8
450	75	8	75	6	80	8
500	75	8	75	6	85	8

Useful capacitor formulas

Reduced voltage:

$$\text{Actual kVAR} = \text{Rated kVAR} \left(\frac{\text{actual voltage}}{\text{rated voltage}}\right)^2$$

Reduced frequency:

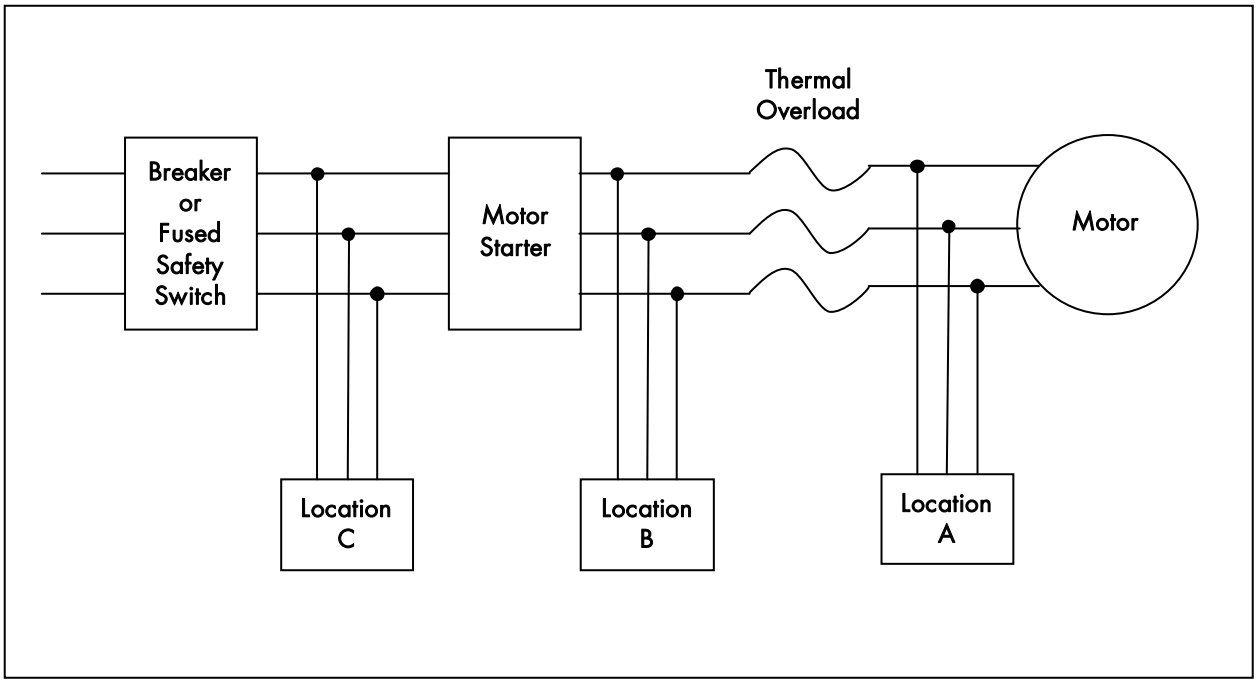
50Hz kVAR rating = (60Hz kVAR rating)(0.83)

Standard data		
Voltage	µF/kVAR	Amps/kVAR
208	61.30	2.78
240	46.00	2.41
480	11.50	1.20
600	7.37	0.96
Based on nominal voltage @ 60 Hz = Nominal kVAR, µF and current		

Connection locations

When applying capacitors to motor circuits, capacitors should usually be connected on the load side of the motor starter (See Figure below). In such installations, it may be desirable to change or adjust the overload protector size by the amount of the current reduction attendant with capacitor installed at location A.

Caution: When applying capacitors to motors which are subject to plugging, jogging, reversing, open transition compound starting (or on many multi-step or multi-speed motors), it is strongly recommended that the capacitor be connected between the motor starter and the disconnect (Location C). This will result in the capacitor being energized even though the motor is not operating. The disconnect provides the appropriate means for the required removal capability per the Code (if it is not serving a branch circuit).



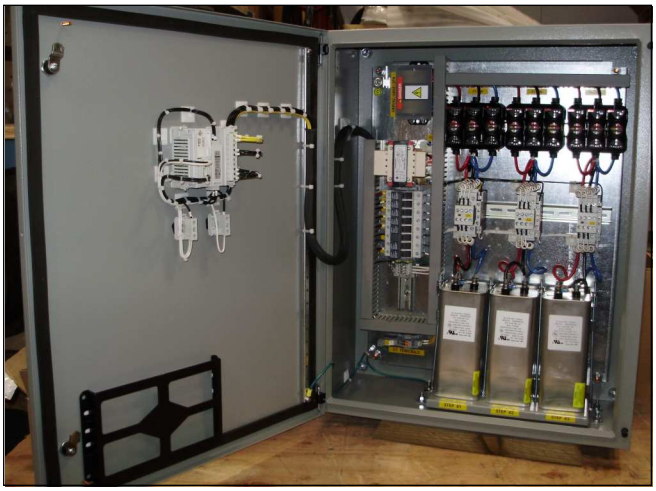
1. Installation at Location A.
Motor side of thermal overload protectors when new motor installation is made and overloads can be sized or adjusted in accordance with reduced current draw (refer to chart on previous page for estimated current reduction), or on existing motors when change of thermal overload is not required.

2. Installation at Location B.
Between the starter and thermal overloads on existing motor applications when overload rating is higher than permitted by code [NEC 430-32(a)].

3. Installation at location C.
On the line side of the starter when separate disconnect means exist. This is a required location when motors are to be jogged, plugged, or reversed; for multi-speed motors; for all starters having open transition; and for starters that in any way disconnect the capacitor momentarily during the cycle and then reconnect the unit.

Note: The length of the capacitor feeder cable should be such that no strain is applied to the power lead connector. Power leads shall be firmly clamped in connectors by tightening connector bolts. Wire lead strands should not move in connector when the lead is moved from side to side by hand. Improper (loose) connections will cause terminal overheating and possible early failure of capacitor unit.

Automatic Power Factor Correction Systems



A computer controller senses the current power factor, and automatically steps on and off capacitor banks in order to achieve the programmed target power factor.

Contact Beaver for details on Automatic systems.

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