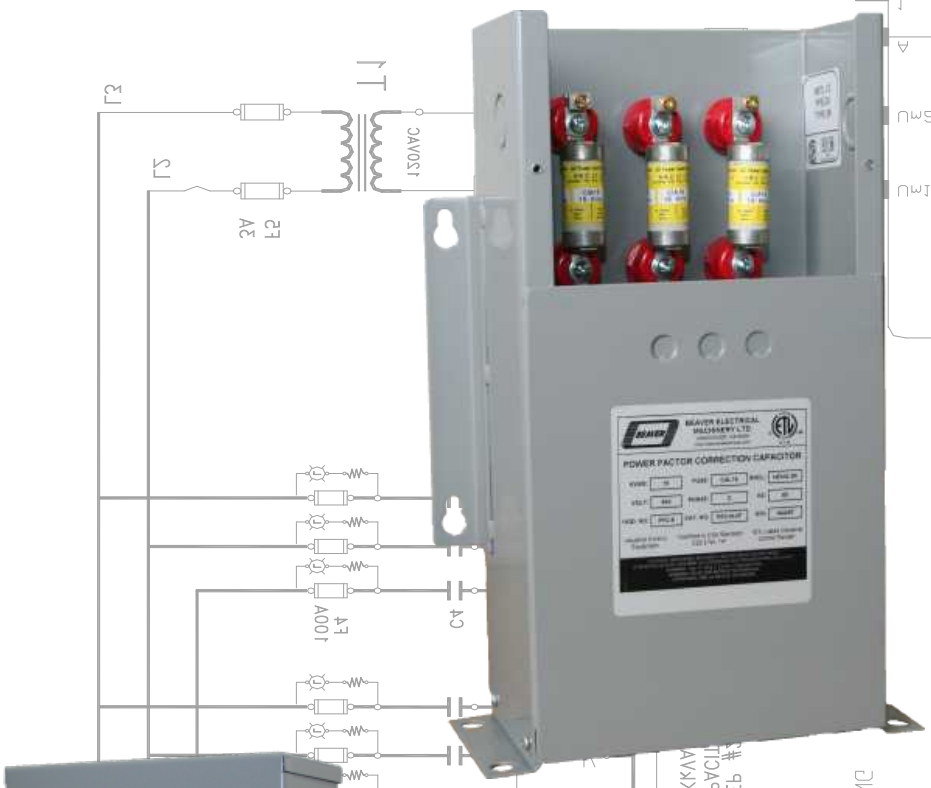
Beaver Power Factor Correction Capacitors



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.

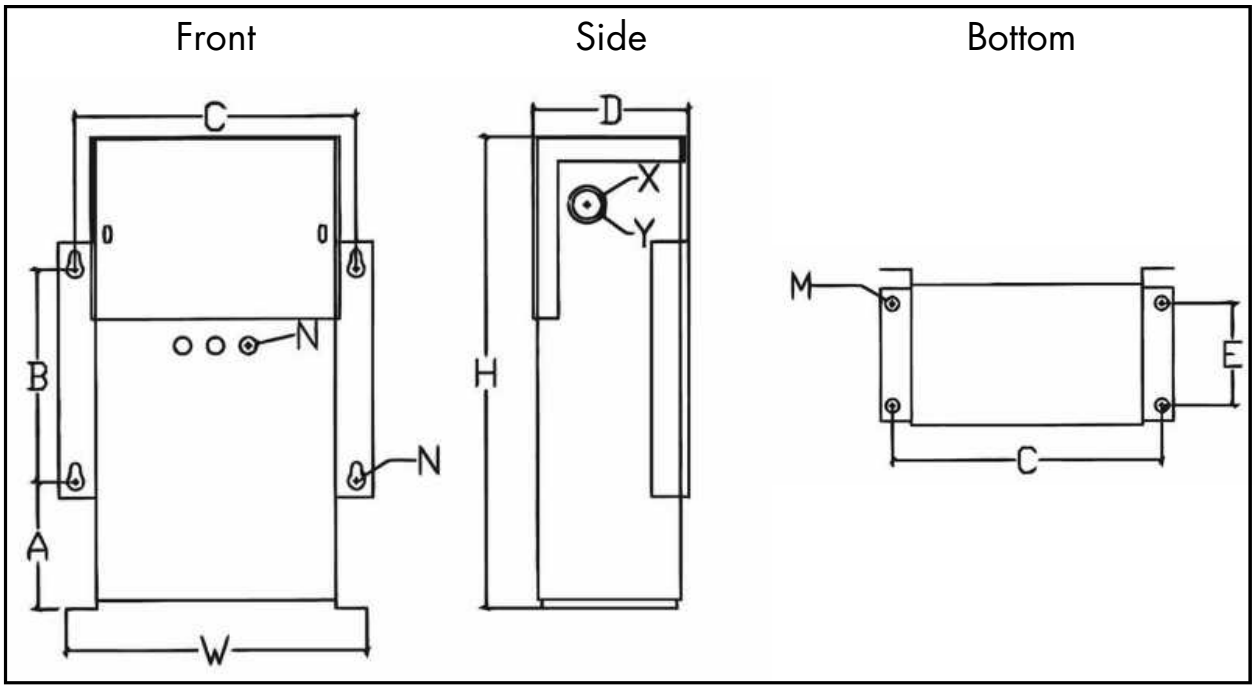
Example: If the present demand is 262 kW and was operating at 82% PF and the desired PF is 95%, you would:

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 C1 - C8



*All enclosures are NEMA 3R rated

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	15.6	14.6	3.25	5.875	8.375	Ø 0.437	Ø 0.5	Ø 0.875	Ø 1.125
C4	4	22.825	9.775	11.21	10.375	7.25	7.875	8.375	Ø 0.437	Ø 0.5	Ø 0.875	Ø 1.125
C6	5-6	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
C8	7-8	24.325	10.625	19.035	18.25	6.75	5.875	10.375	Ø 0.437	Ø 0.5	Ø 0.875	Ø 1.125

208 Volt			480 Volt			600 Volt		
kVAR	Size Code	Max lb	kVAR	Size Code	Max lb	kVAR	Size Code	Max lb
0 - 4.7	C1	17	0 - 12.5	C1	17	0 - 15	C1	18
5.6 - 22.5	C2	42	15 - 60	C2	37	17.5 - 60	C2	37
26.25 - 33.75	C3	52	65 - 90	C3	52	65 - 90	C3	52
34.50 - 45	C4	67	95 - 120	C4	57	95 - 120	C4	57
50.63 - 67.50	C6	73	125 - 160	C6	77	125 - 180	C6	79
78.87 - 90.13	C8	98	180 - 240	C8	89	200 - 240	C8	89

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

Amperage and Fusing

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

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:

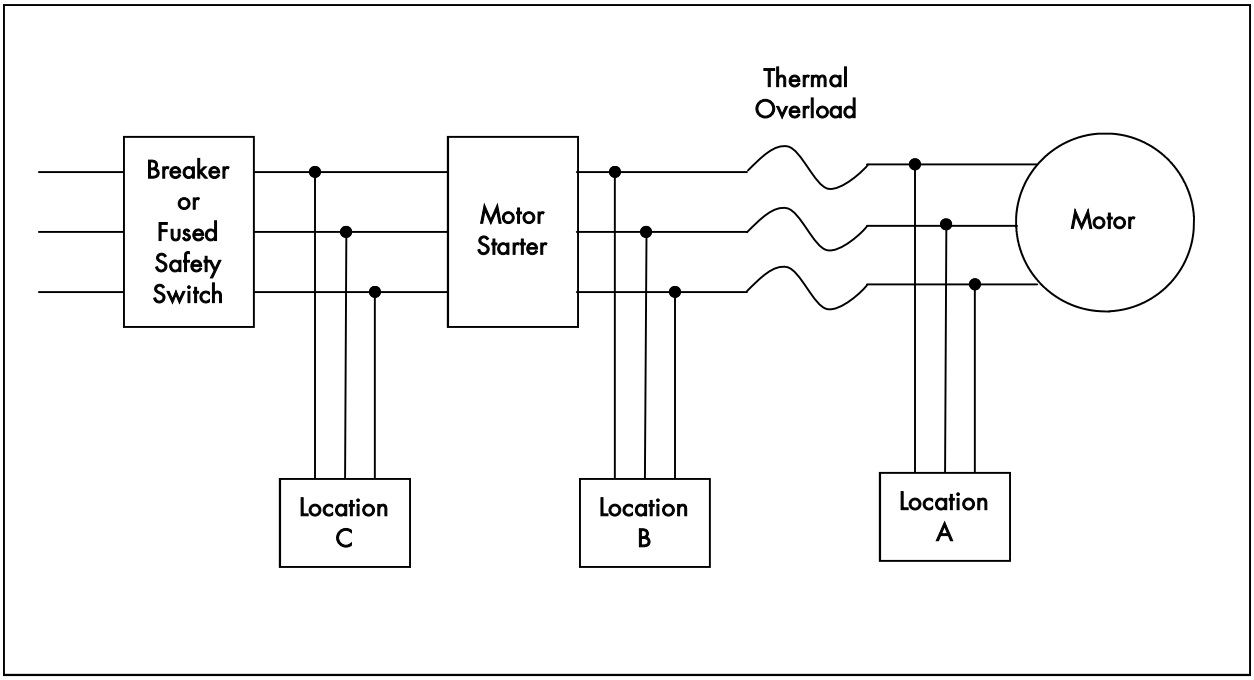
50Hz kVAR rating = (60Hz kVAR rating)(0.83)

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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