

Power Capacitor

**Shreem**  
ELECTRIC LTD

[www.metroelectric.com](http://www.metroelectric.com)

# Power Capacitors

## CONSTRUCTION FEATURES

- Capacitors are protected by internal element fuses or by external unit fuse (Fig.2)
- High grade steel tank with epoxy light gray finish for resistant to severely corrosive atmospheres
- Wet process - porcelain bushing glazed for high strength, durability and hermetically sealed to the capacitor tank.
- Internal discharge resistors that reduce terminal voltage at 50 Volts or less within ten minutes after capacitor has been disconnected.
- Stainless Steel - nameplate containing required IS data.

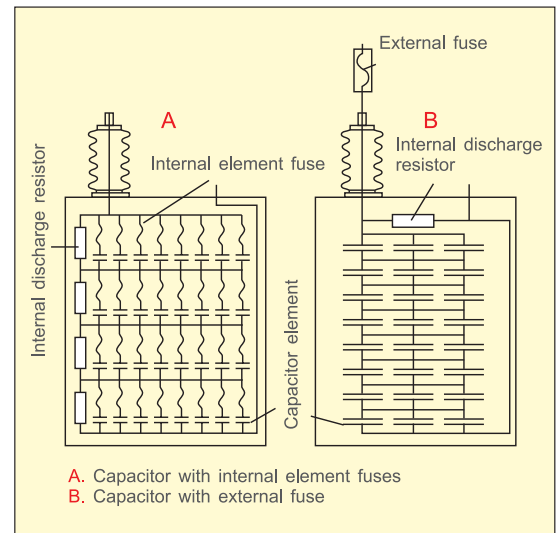


Fig.2

## CAPACITOR BANK-SIZING

A capacitive KVAR required for improvement of power factor at a given load can be made from the nomogram in Fig.3. However, in most cases the capacitor bank rating has to be carefully selected after due consideration of rated voltage of the system, system over-voltages, harmonics in the system, rating of series reactor if any, etc. Besides the correct sizing of the capacitor bank, the reliability also depends on the right selection of associated equipment such as the circuit breaker, series reactor, protective relays, etc.

Above all, it is essential to check that the capacitor installation will not cause dangerous stress to the user's system due to resonance.

TABLE (1)

Following table is used for calculating the necessary capacitor power rating  $Q_c$  (kVAR), required to improve the power factor of a load  $P$  (kW).

$$Q_c = k \times P$$

## EXAMPLE

What is the capacitor power rating required to increase the power factor of an installation from 0.65 to 0.97 if the load  $P$  is 1500 kW ?

From the nomogram  $K = 0.92$  and hence

$$Q_c = 0.92 \times 1500 = 1350 \text{ KVAR}$$

original power factor $\cos\phi_1$	conversion factor F for a target power factor $\cos\phi_2$									
	0.70	0.75	0.80	0.85	0.90	0.92	0.94	0.96	0.98	1.00
0.20	3.879	4.017	4.149	4.279	4.415	4.473	4.536	4.607	4.696	4.899
0.25	2.853	2.991	3.123	3.253	3.389	3.447	3.510	3.581	3.670	3.873
0.30	2.160	2.298	2.430	2.560	2.695	2.754	2.817	2.888	2.977	3.180
0.35	1.656	1.795	1.926	2.057	2.192	2.250	2.313	2.385	2.473	2.676
0.40	1.271	1.409	1.541	1.672	1.807	1.865	1.928	2.000	2.088	2.291
0.45	0.964	1.103	1.235	1.365	1.500	1.559	1.622	1.693	1.781	1.985
0.50	0.712	0.850	0.982	1.112	1.248	1.306	1.369	1.440	1.529	1.732
0.55	0.498	0.637	0.768	0.899	1.034	1.092	1.156	1.227	1.315	1.518
0.60	0.313	0.451	0.583	0.714	0.849	0.907	0.970	1.042	1.130	1.333
0.65	0.149	0.287	0.419	0.549	0.685	0.743	0.806	0.877	0.966	1.169
0.70		0.138	0.270	0.400	0.536	0.594	0.657	0.729	0.817	1.020
0.75			0.132	0.262	0.398	0.456	0.519	0.590	0.679	0.882
0.80				0.130	0.266	0.324	0.387	0.458	0.547	0.750
0.85					0.135	0.194	0.257	0.328	0.417	0.620
0.90						0.058	0.121	0.193	0.281	0.484
0.95								0.037	0.126	0.329

Table1

# Power Capacitor

## Single / Three phase High Voltage Capacitors 50 HZ / 60 Hz From 1 KV to 200 KV

- Maximum voltage 200 kV
- Maximum output 1000 KVAR (Single Phase)
- All Polypropylene (APP) film dielectric
- Low Losses
- Indoor or Outdoor application up to 200 KV BIL
- Superior electrical performance
- Improved tank rupture characteristics.

Shreem - all film capacitors features the latest designed, manufactured and tested to meet or exceed the requirements of applicable IEC & IS & IEEE standard.

Their low cost per kVAr makes these capacitors a simple, economical source of reactive power on electric power systems for,

- Improving power factor
- Reducing line losses
- Decreasing voltage drop

Power capacitors can be installed singly or in factory - assembled switched or unswitched banks in

- Pole mounting racks
- Open substation blocks
- Pad Mounted Bank

## CAPACITOR APPLICATION

Capacitor application requires an evaluation of the power system to determine.

- The kVAr needs
- The most effective location
- The necessary protection

In general capacitors are installed

- At the substation : To supply the system var needs most effectively.
- At the near the load center : To obtain the optimum var supply and voltage correction.
- At the end of the line : To achieve maximum voltage correction.
- Life expectancy > 1 0,000



## RATINGS

Shreem Capacitors are rated in continuous kVAr, voltage and Frequency for operating within the - 40<sup>o</sup> to + 55<sup>o</sup> C ambient temperature range. Designed to produce not less than rated kVAr at rated voltage and frequency, they are subjected to all applicable IEC/IS/IEEE standard dielectric tests.

## PERFORMANCE STANDARD

- Continuous operating capability
- Reserved for contingency situation
- 110% of rated voltage rms
- 120% of rated Vcrest (including Harmonics, excluding transients)
- 150% of nominal rms (including Fundamentals and Harmonics Current)
- 135% of rated KVAR

The maximum recommended working voltage of capacitor is 110% of rated voltage. Shreem capacitors include a safety factor that permits them to tolerate without damage momentary over voltages caused by switching or load changes. Capacitor-rated frequency is 50/60Hz, kVAr output varies directly as the ratio applied frequency to rated frequency. Capacitors designed to operate at other frequencies are also available.

# Power Capacitor

## APPLICATION

- The capacitors are designed for power factor correction and harmonic filtration in power network

## BENEFITS

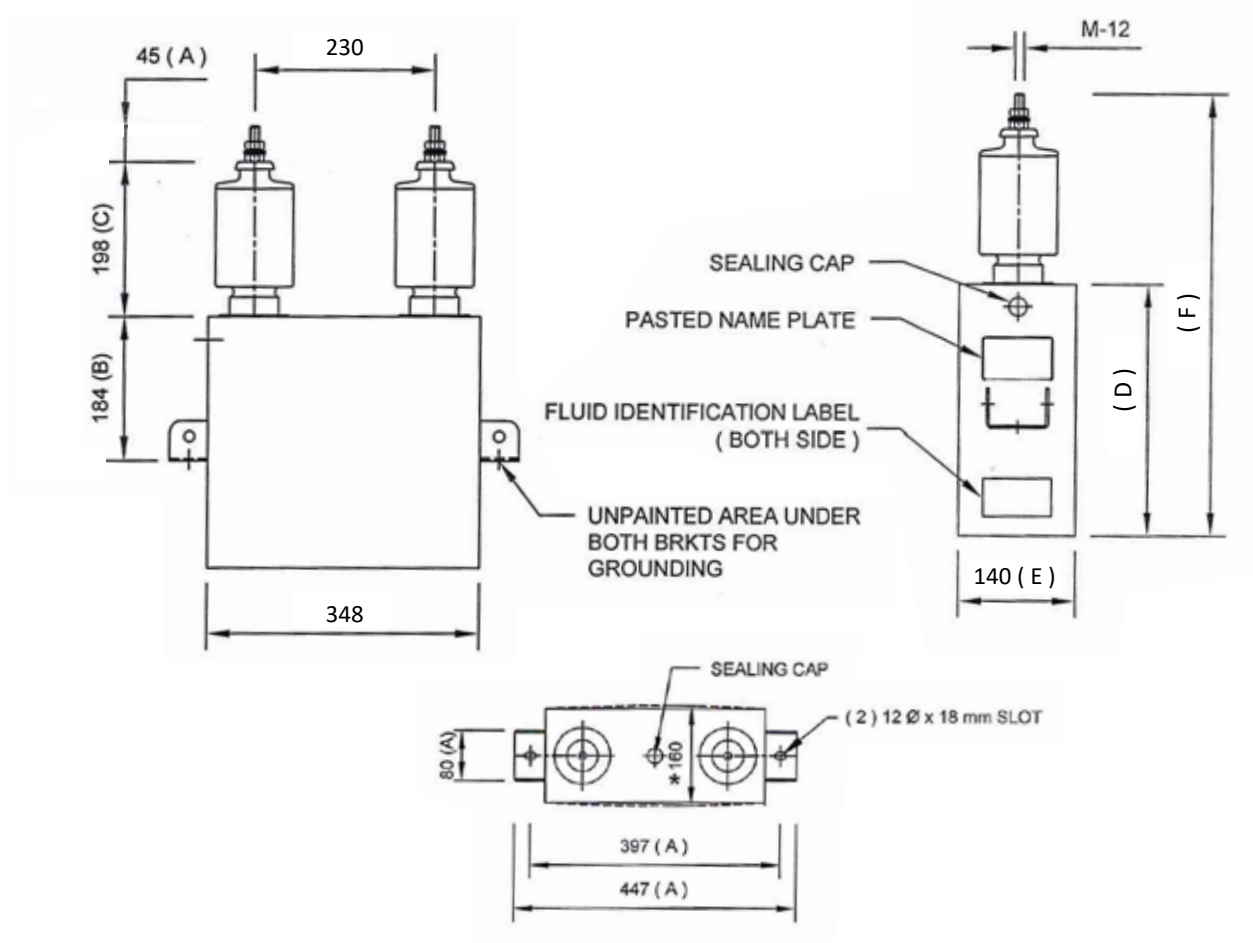
- Improve power factor.
- Reduce line losses.
- Decrease voltage drop.

### Technical Data and Limit Values

Rated Voltage	Un	Single -Phase : 1 - 24 KV 25-1000 KVAR (Rated current not to exceed 150 Amp) Three -Phase : 1 - 15 KV 25-800 KVAR (Rated current not to exceed 150 Amp)
Rated frequency	F <sub>n</sub>	50/60 Hz
Standards		IEC 60871-1 EN 60871-1 IEEE 18
Max. overvoltage	U <sub>max</sub>	Un + 10 % up to 12 hours daily Un + 15 % up to 30 minutes daily Un + 20 % up to 5 minutes daily Un + 30 % up to 1 minute daily <b>It is assumed that the above overvoltages having value higher than 1.15 Un do not occur more than 200 times in the capacitors life.</b>
Overcurrent (According to above standard)	I <sub>max</sub> I <sub>s</sub>	1.5xI <sub>n</sub> <b>As per IEC 60871-1</b>
Capacitance tolerance		-5 / +10 %
Test voltage, terminal/terminal	U <sub>TT</sub>	4.3 x Un DC, 10 sec.
Test voltage, terminal/case	U <sub>TC</sub>	According to the insulation level, for 10 sec.
Inrush current		<b>Max. 100 times of rated current as per IEC 60871-1</b>
Losses - Dielectric - total	tan δ	0.06 W/kvar 0.2 W/kvar
Statistical life expectancy		> 150 000 hours
Protection degree		
Ambient temperature category	°C	- 25 / D - max. temp. 55°C (D) - highest over period of 24 h : 40°C - highest over period of 1 year : 30°C - 40 / D - on request
Cooling		naturally air cooled
Humidity		
Altitude		max, 4000 m above sea level
Mounting position		vertical and horizontal(narrow side)
Mounting		side brackets, bottom brackets
Case		1.5 mm thick, 409 grade stainless steel sheet for Indoor / Outdoor sheet 1.5 mm thick, 316 grade / 304 grade stainless steel sheet on request
Dielectric		all film
IMPREGNATION		JARYLEC (Non-PCB ; Non Toxic) PXE (Non-PCB ; Non Toxic)
Discharge resistors		built in 75 V, 10 minutes as per IEC

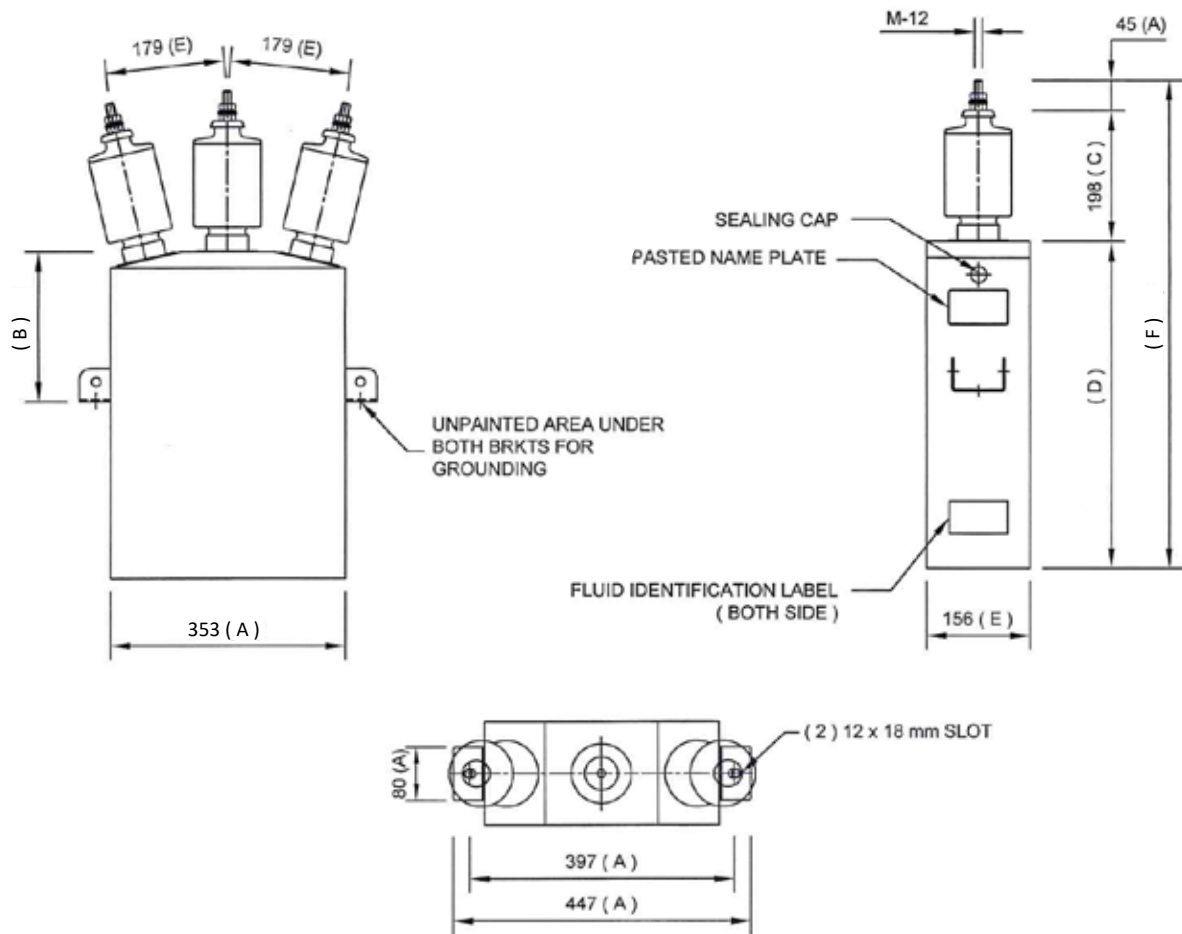


# Power Capacitor



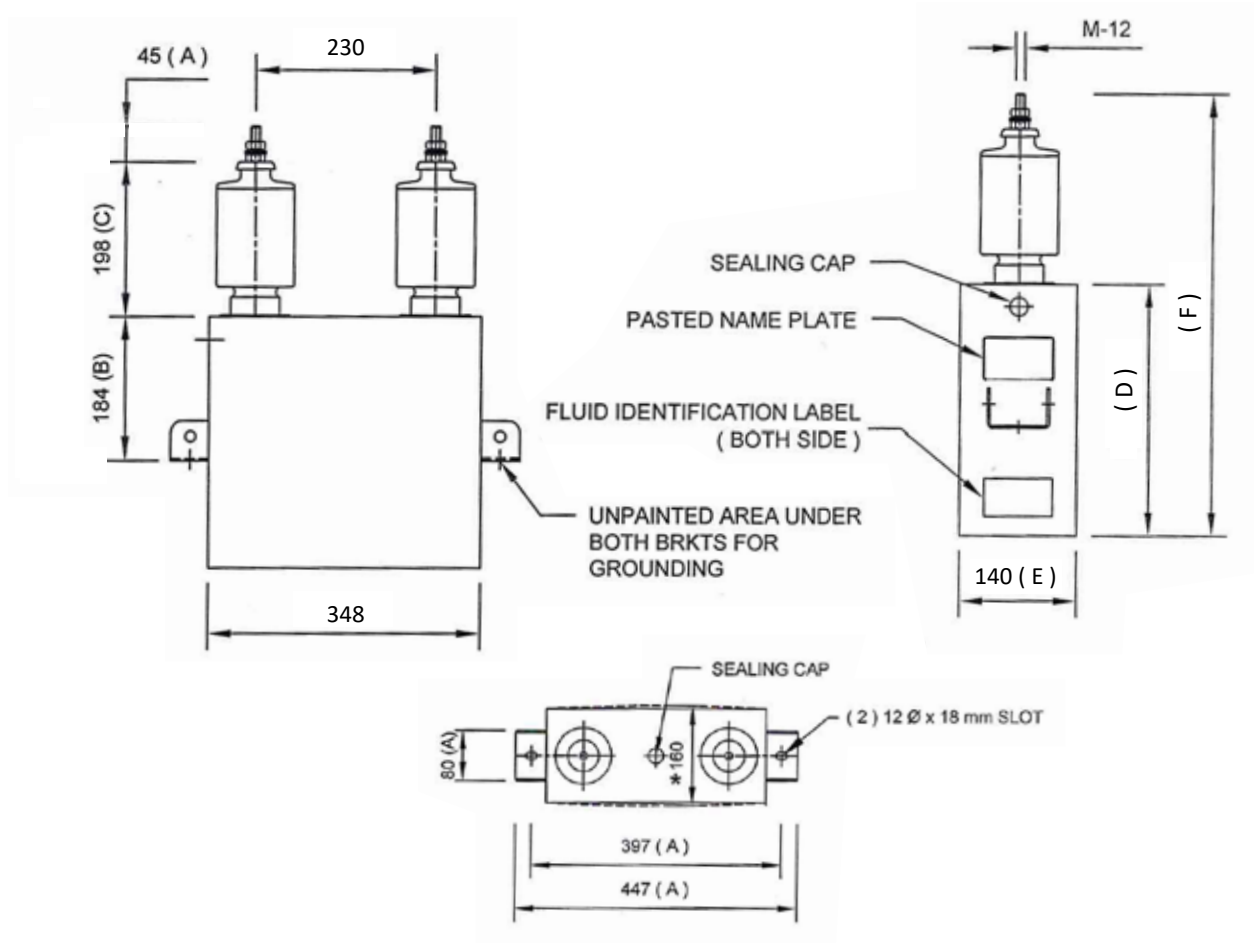
System Voltage		11 KV 1Ø 50 HZ							
Rated Voltage		12 KV 1Ø 50 HZ							
model	Capacity			Current(A)	Size (cm)				
	KVar@11KV	KVar@12KV	Capacity (µF)		B	C	D	E	F
SEV-100-50	50	59	1.32	4.54	13	19.8	13	14	33.5
SEV-100-75	75	89	1.97	6.82	17	19.8	17	14	37.5
SEV-100-100	100	119	2.63	9.09	18.4	19.8	35	14	59.3
SEV-100-150	150	178	3.95	13.64	18.4	19.8	36.5	14	60.8
SEV-100-200	200	238	5.26	18.18	18.4	19.8	38	14	62.3
SEV-100-250	250	297	6.58	22.73	18.4	19.8	42.4	14	62.9
SEV-100-300	300	357	7.9	27.27	18.4	19.8	48.9	14	69.4
SEV-100-400	400	476	10.53	36.36	18.4	19.8	63	14	83.5
SEV-100-500	500	595	13.16	45.45	18.4	19.8	83	14	103.5

# Power Capacitor



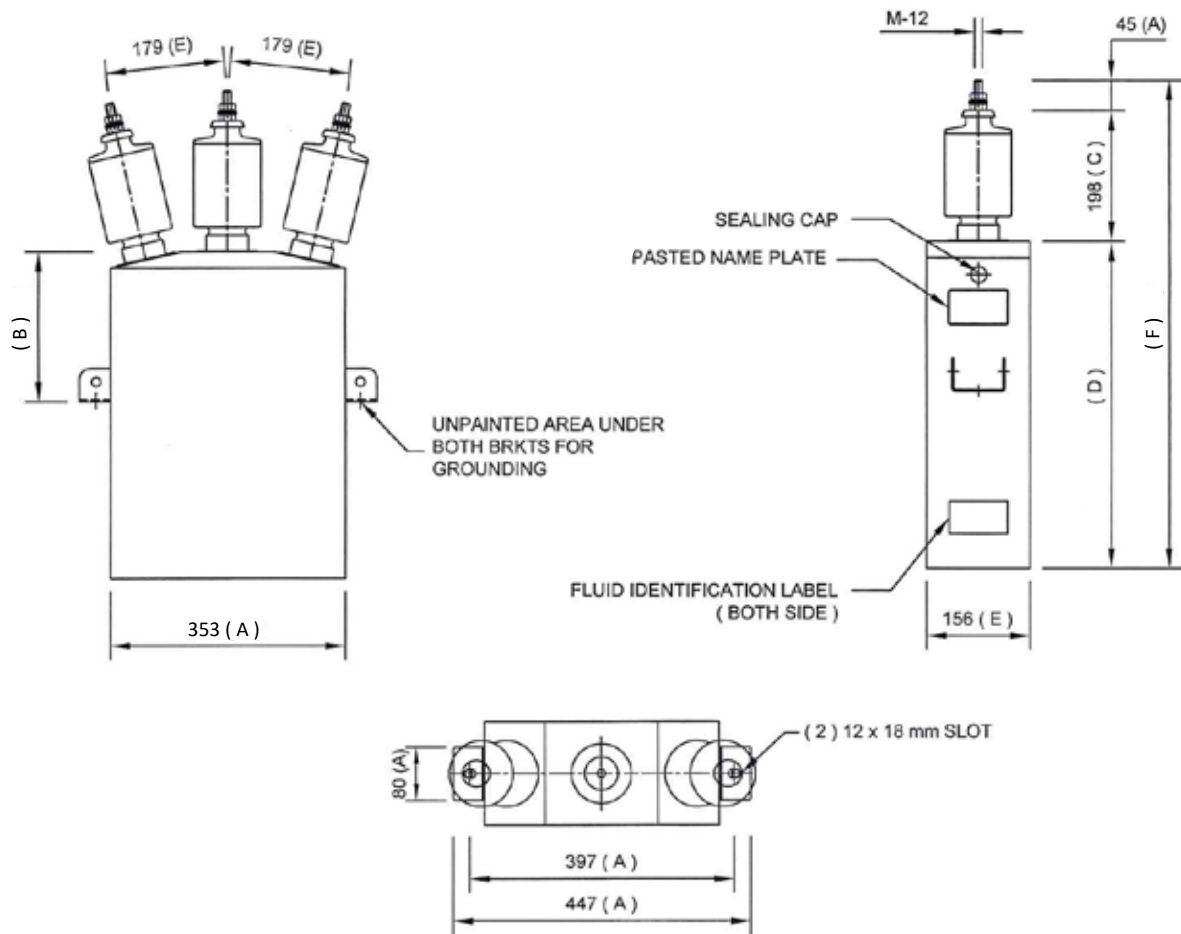
System Voltage		11 KV 3Ø 50 HZ							
Rated Voltage		12 KV 3Ø 50 HZ							
model	Capacity			Current(A)	Size (cm)				
	KVar@11KV	KVar@12KV	Capacity (µF)		B	C	D	E	F
SEV-3-100-50	50	59	1.32	2.62	17.6	19.8	17.6	15.6	42.1
SEV-3-100-75	75	89	1.97	3.94	22.5	19.8	23	15.6	47.5
SEV-3-100-100	100	119	2.63	5.25	22.5	19.8	35	15.6	59
SEV-3-100-150	150	178	3.95	7.88	22.5	19.8	36.5	15.6	60.8
SEV-3-100-200	200	238	5.26	10.5	22.5	19.8	38	15.6	62.3
SEV-3-100-250	250	297	6.58	13.13	22.5	19.8	57	15.6	81.5
SEV-3-100-300	300	357	7.9	15.76	22.5	19.8	66	15.6	90.5
SEV-3-100-400	400	476	10.53	21.02	22.5	19.8	85	15.6	109.5
SEV-3-100-500	500	595	13.16	16.27	22.5	19.8	112	15.6	136.5

# Power Capacitor



System Voltage		6.6 KV 1Ø 50 HZ							
Rated Voltage		7.2 KV 1Ø 50 HZ							
model	Capacity			Current(A)	Size (cm)				
	KVar@6.6KV	KVar@7.2KV	Capacity (µF)		B	C	D	E	F
SEV-66-50	50	59	3.66	7.57	13	19.8	13	14	33.5
SEV-66-75	75	89	5.48	11.36	17	19.8	17	14	37.5
SEV-66-100	100	119	7.31	15.15	18.4	19.8	35	14	59
SEV-66-150	150	178	10.97	22.72	18.4	19.8	36.5	14	60.8
SEV-66-200	200	238	14.62	30.3	18.4	19.8	38	14	62.3
SEV-66-250	250	297	18.28	37.87	18.4	19.8	42.4	14	62.9
SEV-66-300	300	357	21.93	45.45	18.4	19.8	48.9	14	69.4
SEV-66-400	400	476	29.24	60.6	18.4	19.8	63	14	83.5
SEV-66-500	500	595	36.56	75.75	18.4	19.8	83	14	103.5

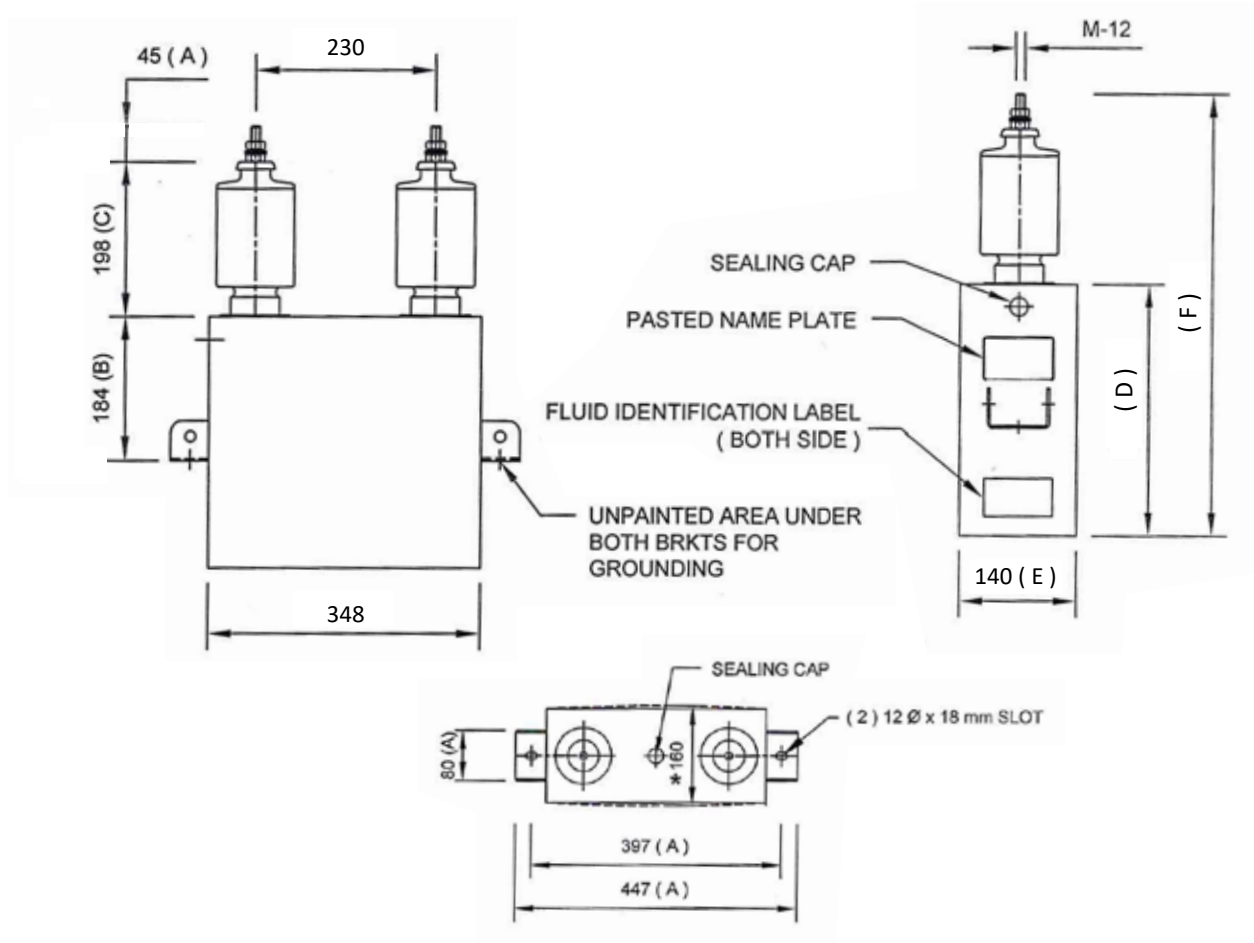
# Power Capacitor



System Voltage		6.6 KV 3Ø 50 HZ							
Rated Voltage		7.2 KV 3Ø 50 HZ							
model	Capacity			Current(A)	Size (cm)				
	KVar@6.6KV	KVar@7.2KV	Capacity (µF)		B	C	D	E	F
SEV-3-66-50	50	59	3.66	4.38	17.6	19.8	17.6	15.6	42.1
SEV-3-66-75	75	89	5.48	6.57	22.5	19.8	23	15.6	47.5
SEV-3-66-100	100	119	7.31	8.76	22.5	19.8	35	15.6	59
SEV-3-66-150	150	178	10.97	13.14	22.5	19.8	36.5	15.6	60.8
SEV-3-66-200	200	238	14.62	17.52	22.5	19.8	38	15.6	62.3
SEV-3-66-250	250	297	18.28	21.89	22.5	19.8	57	15.6	81.5
SEV-3-66-300	300	357	21.93	26.27	22.5	19.8	66	15.6	90.5
SEV-3-66-400	400	476	29.24	35.03	22.5	19.8	85	15.6	109.5
SEV-3-66-500	500	595	36.56	43.79	22.5	19.8	112	15.6	136.5

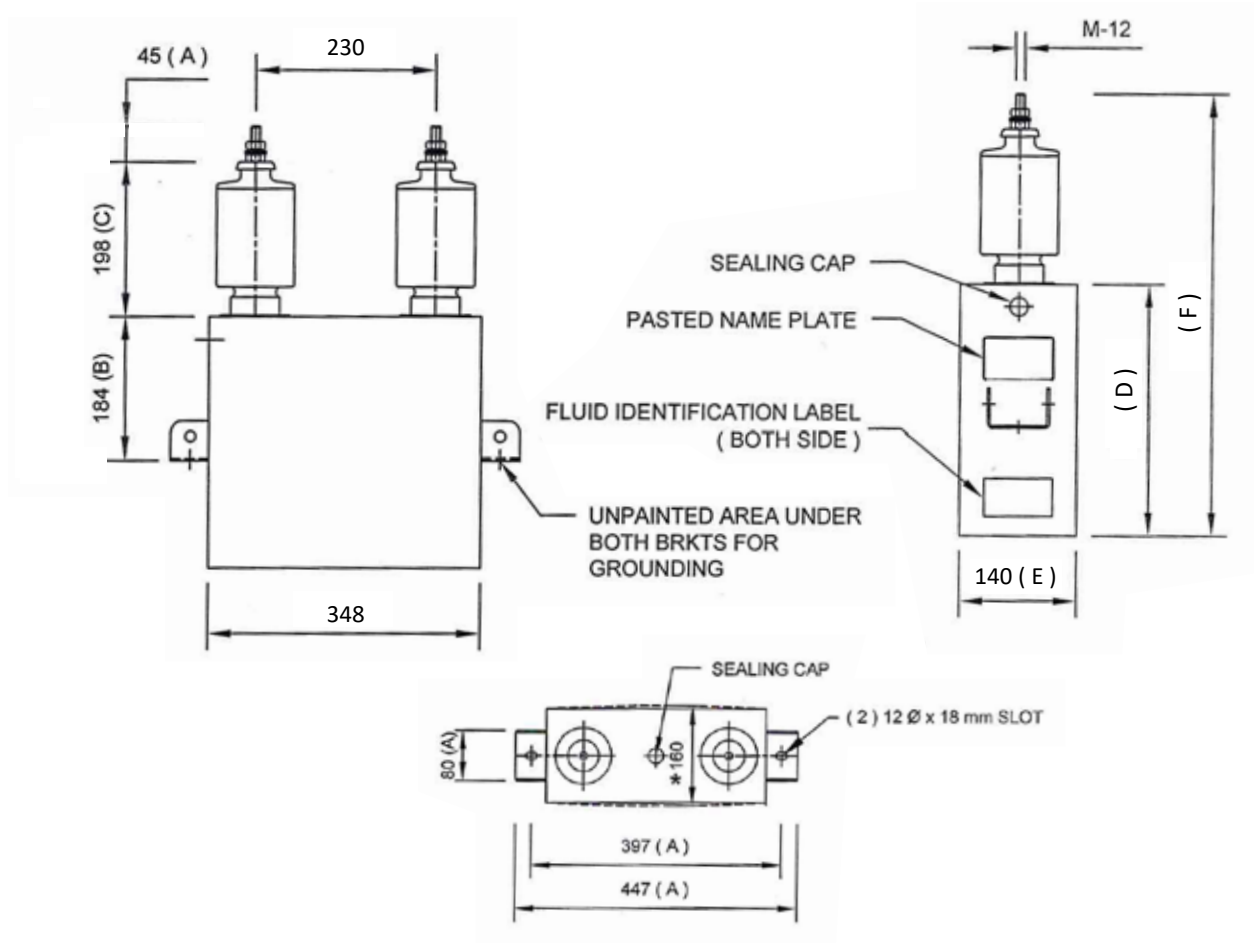


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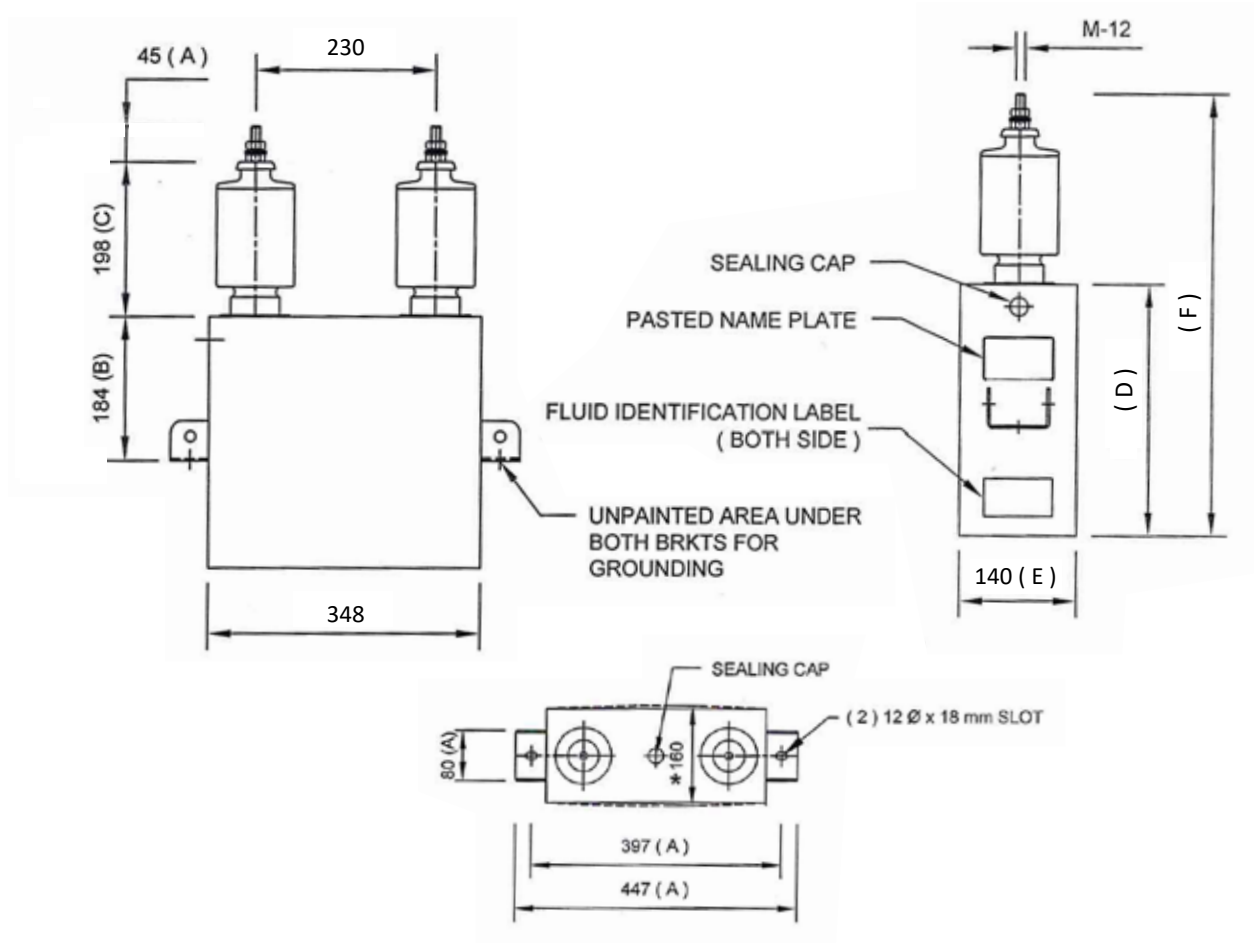
System Voltage		6.35 KV 1Ø 50 HZ							
Rated Voltage		7.2 KV 1Ø 50 HZ							
model	Capacity			Current(A)	Size (cm)				
	KVar@6.35KV	KVar@7.2KV	Capacity (µF)		B	C	D	E	F
SEV-63-50	50	64	3.95	7.87	13	19.8	13	14	33.5
SEV-63-75	75	96	5.92	11.81	17	19.8	17	14	37.5
SEV-63-50	100	128	7.9	15.75	18.4	19.8	35	14	59
SEV-63-75	150	192	11.85	23.62	18.4	19.8	36.5	14	60.8
SEV-63-50	200	257	15.8	31.50	18.4	19.8	38	14	62.3
SEV-63-75	250	321	19.72	39.37	18.4	19.8	42.4	14	62.9
SEV-63-50	300	385	23.69	47.24	18.4	19.8	48.9	14	69.4
SEV-63-75	400	514	31.59	62.99	18.4	19.8	63	14	83.5
SEV-63-50	500	642	39.49	78.74	18.4	19.8	83	14	103.5

# Power Capacitor



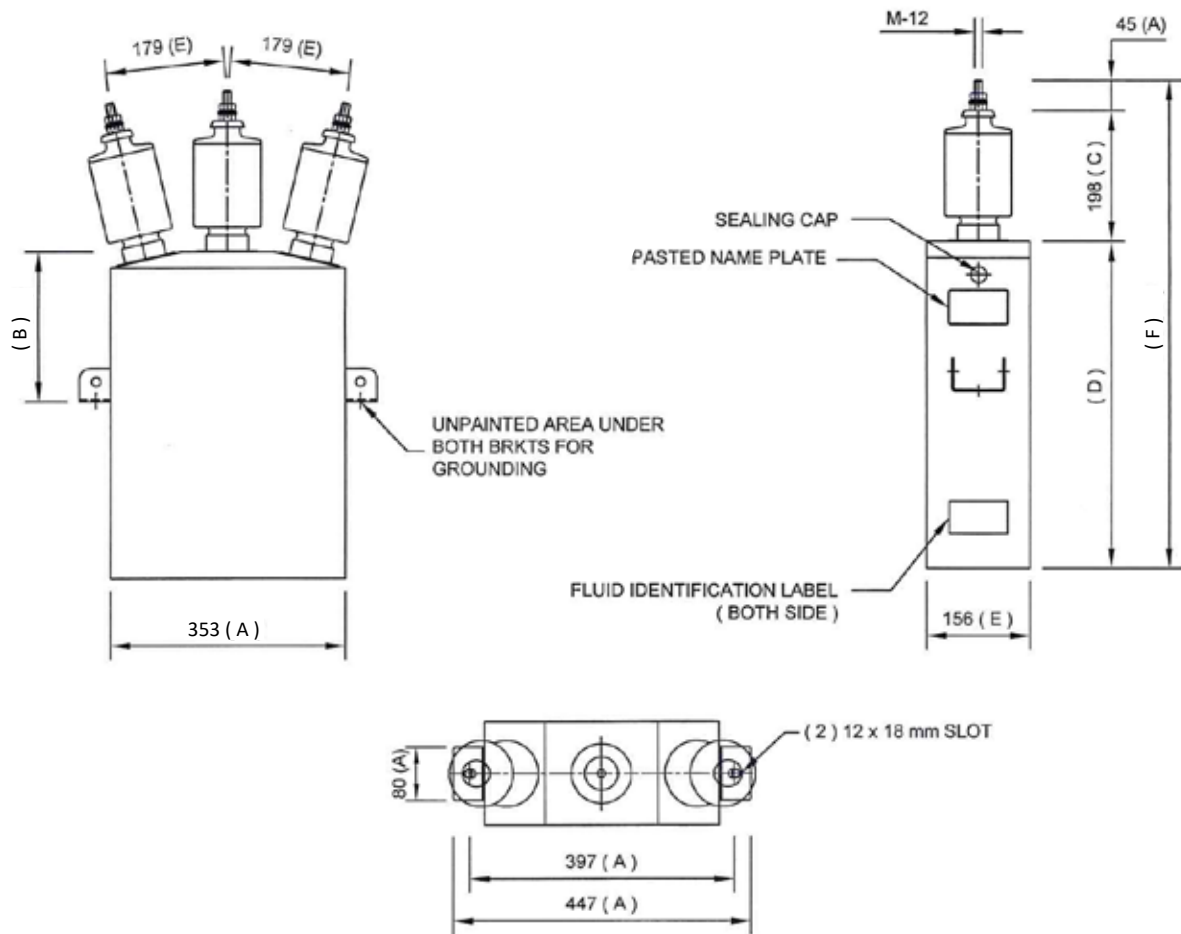
System Voltage		3.81 KV 1Ø 50 HZ							
Rated Voltage		4.2 KV 1Ø 50 HZ							
model	Capacity			Current(A)	Size (cm)				
	KVar@3.81KV	KVar@4.2KV	Capacity (µF)		B	C	D	E	F
SEV-38-50	50	60	10.97	13.12	13	19.8	13	14	33.5
SEV-38-75	75	90	16.45	19.68	17	19.8	17	14	37.5
SEV-38-50	100	120	21.94	26.24	18.4	19.8	35	14	59
SEV-38-75	150	181	32.91	39.37	18.4	19.8	36.5	14	60.8
SEV-38-50	200	241	43.88	52.49	18.4	19.8	38	14	62.3
SEV-38-75	250	302	54.85	65.61	18.4	19.8	42.4	14	62.9
SEV-38-50	300	362	65.82	78.74	18.4	19.8	48.9	14	69.4
SEV-38-75	400	483	87.76	104.98	18.4	19.8	63	14	83.5
SEV-38-50	500	604	109.7	131.23	18.4	19.8	83	14	103.5

# Power Capacitor



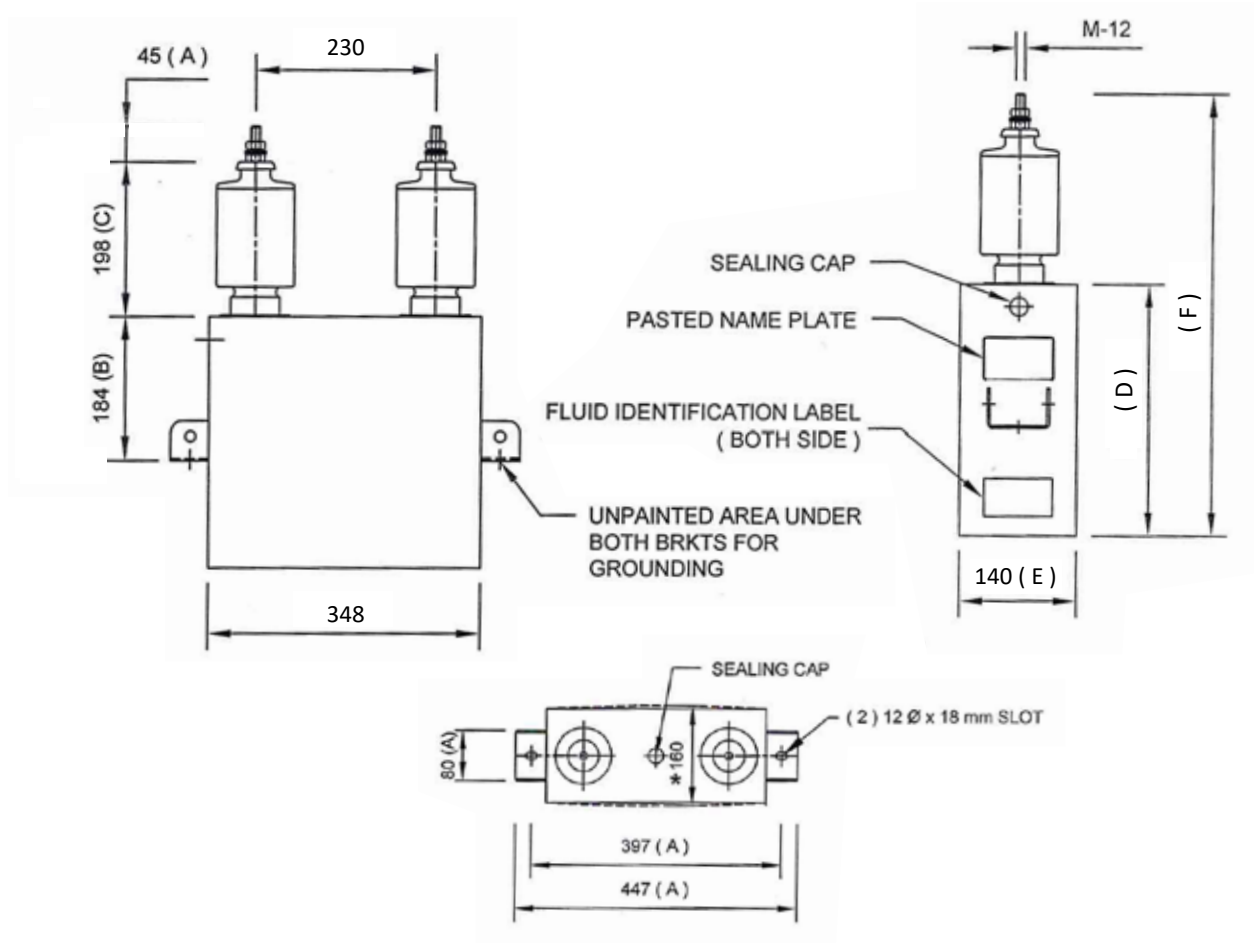
System Voltage		3.3 KV 1Ø 50 HZ							
Rated Voltage		3.6 KV 1Ø 50 HZ							
model	Capacity		Capacity (µF)	Current(A)	Size (cm)				
	KVar@3.3KV	KVar@3.6KV			B	C	D	E	F
SEV-33-50	50	59	14.62	15.15	13	19.8	13	14	33.5
SEV-33-75	75	89	21.33	22.72	17	19.8	17	14	37.5
SEV-33-100	100	119	29.24	30.3	18.4	19.8	35	14	59
SEV-33-150	150	178	43.87	45.45	18.4	19.8	36.5	14	60.8
SEV-33-200	200	238	58.49	60.6	18.4	19.8	38	14	62.3
SEV-33-250	250	297	73.11	75.75	18.4	19.8	42.4	14	62.9
SEV-33-300	300	357	87.73	90.9	18.4	19.8	48.9	14	69.4
SEV-33-400	400	474	116.98	121.21	18.4	19.8	63	14	83.5

# Power Capacitor



System Voltage		3.3 KV 3Ø 50 HZ							
Rated Voltage		3.6 KV 3Ø 50 HZ							
model	Capacity			Current(A)	Size (cm)				
	KVar@3.3KV	KVar@3.6KV	Capacity (µF)		B	C	D	E	F
SEV-3-33-50	50	59	14.62	8.76	17.6	19.8	17.6	15.6	42.1
SEV-3-33-75	75	89	21.92	13.14	22.5	19.8	23	15.6	47.5
SEV-3-33-50	100	119	29.24	17.52	22.5	19.8	35	15.6	59
SEV-3-33-75	150	178	43.87	26.27	22.5	19.8	36.5	15.6	60.8
SEV-3-33-50	200	238	58.49	35.05	22.5	19.8	38	15.6	62.3
SEV-3-33-75	250	297	73.11	43.8	22.5	19.8	57	15.6	81.5
SEV-3-33-50	300	357	87.73	52.55	22.5	19.8	66	15.6	90.5
SEV-3-33-75	400	476	116.98	70.06	22.5	19.8	85	15.6	109.5
SEV-3-33-50	500	595	146.22	87.58	22.5	19.8	112	15.6	136.5

# Power Capacitor



System Voltage		1.91 KV 1Ø 50 HZ							
Rated Voltage		2.4 KV 1Ø 50 HZ							
model	Capacity			Current(A)	Size (cm)				
	KVar@1.9KV	KVar@2.4KV	Capacity (µF)		B	C	D	E	F
SEV-19-50	50	78	43.65	23.8	13	19.8	13	14	33.5
SEV-19-75	75	118	65.47	35.7	17	19.8	17	14	37.5
SEV-19-100	100	157	87.3	47.6	18.4	19.8	35	14	59
SEV-19-150	150	236	130.95	71.42	18.4	19.8	36.5	14	60.8
SEV-19-200	200	315	174.6	95.23	18.4	19.8	38	14	62.3
SEV-19-250	250	394	218.24	119.04	18.4	19.8	42.4	14	62.9



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