



GE Power Controls

### L V Power Capacitor



**GE-PØVAR**  
Capacitors





## LV Power Capacitor

GE is world wide leader in capacitor technology.

GE manufactures capacitors in large varieties suitable for all Industrial application viz. - KVAR for PF improvement, Medium & High frequency capacitors for induction furnaces. Capacitors for lighting & motor application, and HV Capacitors for transmission network.

Now, GE power controls introduces LV Power Capacitors in India. **GE-PØVAR** Capacitors. These capacitors are ideally suited for power factor improvement. GE offers capacitors in the following three varieties.

- Type MPP
- Type APP
- Type MD

The capacitors are available in various ratings as individual units, banked capacitors and APFC panels.

GE offers Comprehensive solutions in reactive power management.

Applications and benefits :

**GE-PØVAR** Capacitors, finds its application in improving the power factor and thereby enhancing overall efficiency of the installation. An improved power factor releases the system capacity to accommodate additional load, reduces maximum demand (KVA), current drawn and improves voltage regulation and equipment life. Besides it accrues financial and commercial Benefits by way of

- Saving in Demand charges (KVA)
- Eliminating low power factor penalties.



**MPP - Metallised Polypropylene - Self Healing capacitors**

- Low Watt loss
- Compact design
- Explosion proof - safe design



**APP - All Polypropylene (Film-Foil type)**

- Long life
- Suitable for most stringent applications
- Safe
- Optimum losses

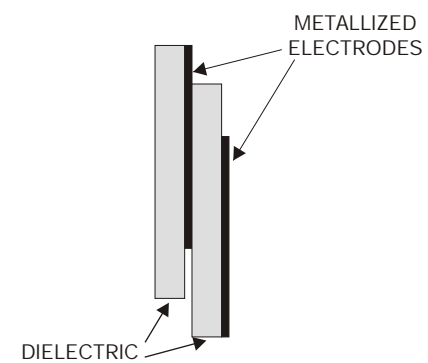


**MD - Mixed dielectric**

- Long life
- Suitable for most stringent applications
- Safe
- Heavy Duty

### Type MPP Capacitor

**Dielectric :** The Capacitor dielectric is a combination of two layers of Low-Loss electrical grade, corona treated Bi-axially oriented Polypropylene Film, on which the electrode is vacuum metallised.



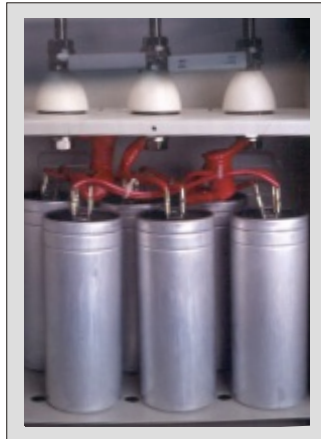
**Electrode :** The electrode is a combination of layers of Zinc + Silver + Aluminium, vacuum deposited on the film surface, one edge of the metallisation layer being reinforced to achieve thorough zinc spray electrode bonding. This type of metallisation is known as heavy edge Metallisation.

**Encapsulant :** The encapsulant/potting compound is a fire-retardant, flexible, polyurethane resin and is eco-friendly, Non-PCB, bio-degradeable, having excellent electrical, physical and highly compatible/non-deteriorating chemical properties. The element is fully protected electrically as also from undesired atmospheric effects.

**Element construction & connections :** The elements are cylindrical in shape, being tightly wound out of two layers of MPP Film on a PPR core and are totally void free. The elements after curing, electrode bonding (zinc spray), soldering and potting are connected in delta for achieving desired output.



## L V Power Capacitor

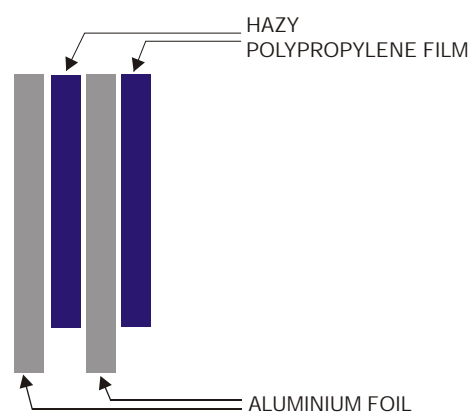


**Safe design :** MPP Capacitor have anti explosion safety feature. They are provided with pressure sensitive disconnecter (PSD) which ensures electrical disconnection under extreme stresses.

**Termination :** Final connections are internally lug-crimped to an assembly of steatite insulator bushings, with solid brass terminal studs + Set of connection hardware (all nickel plated).

### Type Mixed Dielectric and APP: Non self-Healing Capacitor

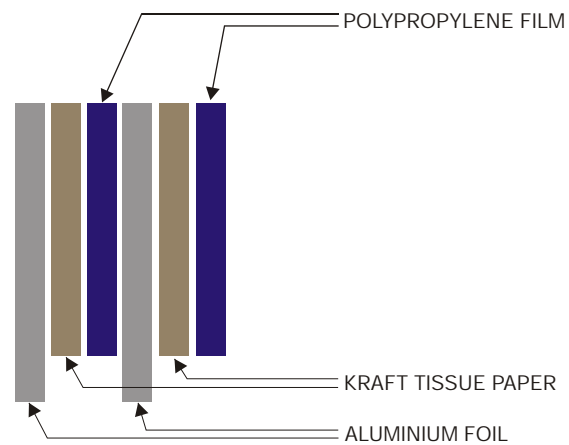
**Dielectric : (APP/ Film - Foil):** The capacitor dielectric comprises layers of low-loss electrical grade, hazy bi-axially oriented polypropylene film, made by the tenter process. The high haze factor and excellent permittivity of the film surface ensures 100% penetration of the impregnant throughout the winding, a factor which is critically important to ensure good performance and long service life.



**Element Construction :** The elements are wound in the extended foil type of construction. One edge of each of the Aluminium Foil

layers protrudes out separately on either side, and are interleaved with the layers of PP film. The inner edges of the foil layers are concealed within the element but are folded at their edge points throughout the winding length. The protruding ends are soldered with an alloy of special solder composition and then inter-phase, fusing, and configuration connections are done. This design eliminates the possibility of build-up of partial discharge inception voltage in the capacitor, and considerably reduces the contact resistance or  $I^2R$  losses thereby reducing thermal stress and enhancing useful life.

**Dielectric : (Mixed Dielectric) :** The capacitor dielectric is a combination of a layer of low loss electrical grade, plain biaxially oriented polypropylene film, interleaved with a layer of electrical grade Kraft Tissue Paper. The presence of the paper and its hygroscopic structure ensures 100% penetration of the impregnant throughout the winding. This uniform distribution of the impregnant contributes in strengthening the dielectric, thereby enhancing the life of the capacitor by increasing its ability to withstand abnormal system hazards such as switching transients and surges, inrush currents, over voltages and over currents.



Type APP & Mixed Dielectric Capacitor have similar electrode and common process for impregnation, vacuum drying & degassing as under.

**Electrode :** The electrode is a 5 Micron layer of 99.9% purity soft annealed aluminium condenser foil. The Foil is edge folded throughout the length of the winding and is end folded at the beginning and end of the winding cycle. This is referred to as Extended Foil Construction, and has distinct advantages over the conventional tab construction with buried foil design.



## L V Power Capacitor

**Impregnant :** The impregnating fluid is an eco-friendly, Non-PCB fluid, biodegradable, and nonflammable, having excellent electrical, physical and highly compatible/non-deteriorating chemical properties.

**Termination :** Final connections are done by internal lug-crimping to an assembly of epoxy moulded insulator bushings, with the terminal studs being insert-moulded. This feature eliminates any chance of impregnant leakage from termination points rendering the unit totally hermetically sealed and fully protected from atmospheric ingress and hazards.

**Vacuum Drying Degassing and Impregnation :** The assembly after tanking, is placed in an impregnating vessel and is pre-heated, degassed and dehumidified under a very high degree of vacuum for removal of moisture content. The impregnant is also pre-treated similarly and is further passed through special filter content columns for reducing its acidity value-pH content. The treated impregnant is then filled individually into each unit to avoid any contamination. Throughout this process the vacuum is maintained at a very high degree of microns.

### Technical Particulars

Capacitor Type	MPP	APP	MD
Reference Standard	IS 2834 - 1986, IS 13340 - 1994	IS 2834 - 1996, IS 13585 - 1994	
Output	1-25 KVAR	← 7.5 - 25 KVAR →	
Rated Voltage (Volts)#	← 415/440 →		
Permissible Overload			
a) Over Current	←	115%	→
b) Over Voltage	←	110%	→
c) Over Output	←	130%	→
Capacitance tolerance	← 5% to + 10% →		
Losses Watts / KVAR	< 0.5	< 1.0	1.5
Life in hrs	50000	100000	> 100000
Protection and Safety	a) Pressure sensitive mechanical interruptor / disconnecter for module. b) Self healing for dielectric. c) Series inductors for phase protection against inrush current. d) External resistance for residual voltage protection.		Internally provided individual element fuses.

### SELECTION

Each design has its own advantages depending on specific areas of application. It is important to select right type of capacitor compatible to your system. Following evaluation parameters may be considered for selection.

	MPP	APP	MD
<u>A Load Profile</u>			
1) Non Linear Load	10%	20%	20%
2) THD Total Harmonic Distortion	5%	15%	15%
<u>B Types of Compensation</u>			
1) Individual Compensation	✓	✓	✓
2) Group Compensation*	*	✓	✓
with Parallel Switching			
<u>C Losses Watts / kVAR</u>	< 0.5	1.0	< 1.5
<u>D Self Healing Properties</u>	Yes	No	No
<u>E Capacitance drift</u>	Yes	No	No
<u>F Life (Hrs)</u>	50000	100000	> 100000

\* switching stages needs to be studied.  
# other voltage rating available on request.



## L V Power Capacitor

SELECTION TABLES : The following table can be referred for calculating the required power capacitor in KVAR for your load.

tg $\phi$ 1	cos $\phi$ 1	0.80	0.86	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00
1.98	0.45	1.230	1.384	1.501	1.532	1.561	1.592	1.626	1.659	1.695	1.737	1.784	1.846	1.988
1.93	0.46	1.179	1.330	1.446	1.473	1.502	1.533	1.657	1.600	1.636	1.677	1.725	1.786	1.929
1.88	0.47	1.130	1.278	1.397	1.425	1.454	1.485	1.519	1.532	1.588	1.629	1.677	1.758	1.881
1.82	0.48	1.076	1.228	1.343	1.370	1.400	1.430	1.464	1.497	1.534	1.575	1.623	1.684	1.826
1.77	0.49	1.030	1.179	1.297	1.326	1.355	1.386	1.420	1.453	1.489	1.530	1.578	1.639	1.782
1.73	0.50	0.982	1.132	1.248	1.276	1.303	1.337	1.369	1.403	1.441	1.481	1.529	1.590	1.732
1.68	0.51	0.936	1.087	1.202	1.230	1.257	1.291	1.323	1.357	1.395	1.435	1.483	1.544	1.686
1.64	0.52	0.894	1.043	1.160	1.188	1.215	1.249	1.281	1.315	1.353	1.393	1.441	1.502	1.644
1.60	0.53	0.850	1.000	1.116	1.144	1.171	1.205	1.237	1.271	1.309	1.349	1.397	1.458	1.600
1.55	0.54	0.809	0.959	1.075	1.103	1.130	1.164	1.196	1.230	1.268	1.308	1.356	1.417	1.559
1.51	0.55	0.769	0.918	1.035	1.063	1.090	1.124	1.156	1.190	1.228	1.268	1.316	1.377	1.519
1.47	0.56	0.730	0.879	0.996	1.024	1.051	1.085	1.117	1.151	1.189	1.229	1.277	1.338	1.480
1.44	0.57	0.692	0.841	0.958	0.986	1.013	1.047	1.079	1.113	1.151	1.191	1.239	1.300	1.442
1.40	0.58	0.665	0.805	0.921	0.949	0.976	1.010	1.042	1.076	1.114	1.154	1.202	1.263	1.405
1.36	0.59	0.618	0.768	0.884	0.912	0.939	0.973	1.005	1.039	1.077	1.117	1.165	1.226	1.368
1.33	0.60	0.584	0.733	0.849	0.878	0.905	0.939	0.971	1.005	1.043	1.083	1.131	1.192	1.334
1.30	0.61	0.549	0.699	0.815	0.843	0.870	0.904	0.936	0.970	1.008	1.048	1.096	1.157	1.299
1.26	0.62	0.515	0.665	0.781	0.809	0.836	0.870	0.902	0.936	0.974	1.014	1.062	1.123	1.265
1.23	0.63	0.483	0.633	0.749	0.777	0.804	0.838	0.870	0.904	0.942	0.982	1.030	1.091	1.233
1.20	0.64	0.450	0.601	0.716	0.744	0.771	0.805	0.837	0.871	0.909	0.949	0.997	1.058	1.200
1.17	0.65	0.419	0.569	0.685	0.713	0.740	0.774	0.806	0.840	0.878	0.918	0.966	1.027	1.169
1.14	0.66	0.388	0.538	0.654	0.682	0.709	0.743	0.775	0.809	0.847	0.887	0.935	0.996	1.138
1.11	0.67	0.358	0.508	0.624	0.652	0.679	0.713	0.745	0.779	0.817	0.857	0.905	0.966	1.108
1.08	0.68	0.329	0.478	0.595	0.623	0.650	0.684	0.716	0.750	0.788	0.828	0.876	0.937	1.079
1.05	0.69	0.299	0.449	0.565	0.593	0.620	0.654	0.686	0.720	0.758	0.798	0.840	0.907	1.049
1.02	0.70	0.270	0.420	0.536	0.564	0.591	0.625	0.657	0.691	0.729	0.769	0.811	0.878	1.020
0.99	0.71	0.242	0.392	0.508	0.536	0.563	0.597	0.629	0.663	0.701	0.741	0.783	0.850	0.992
0.96	0.72	0.213	0.364	0.479	0.507	0.534	0.568	0.600	0.634	0.672	0.712	0.754	0.821	0.963
0.93	0.73	0.186	0.336	0.452	0.480	0.507	0.541	0.573	0.607	0.645	0.685	0.727	0.794	0.936
0.90	0.74	0.159	0.309	0.425	0.453	0.480	0.514	0.546	0.580	0.618	0.658	0.700	0.767	0.909
0.88	0.75	0.132	0.282	0.398	0.426	0.453	0.487	0.519	0.553	0.591	0.631	0.673	0.740	0.882
0.85	0.76	0.105	0.255	0.371	0.399	0.426	0.460	0.492	0.526	0.564	0.604	0.652	0.713	0.855
0.82	0.77	0.079	0.229	0.345	0.373	0.400	0.434	0.466	0.500	0.538	0.578	0.620	0.687	0.829
0.80	0.78	0.053	0.202	0.319	0.347	0.374	0.408	0.440	0.474	0.512	0.552	0.594	0.661	0.803
0.77	0.79	0.026	0.176	0.292	0.320	0.347	0.381	0.413	0.447	0.485	0.525	0.567	0.634	0.776
0.75	0.80	-----	0.150	0.266	0.294	0.321	0.355	0.387	0.421	0.459	0.499	0.541	0.608	0.750
0.72	0.81	-----	0.124	0.240	0.268	0.295	0.329	0.361	0.395	0.433	0.473	0.515	0.582	0.724
0.69	0.82	-----	0.098	0.214	0.242	0.269	0.303	0.335	0.369	0.407	0.447	0.489	0.556	0.698
0.67	0.83	-----	0.072	0.188	0.216	0.243	0.277	0.309	0.343	0.381	0.421	0.463	0.530	0.672
0.64	0.84	-----	0.046	0.162	0.190	0.217	0.251	0.283	0.317	0.355	0.395	0.437	0.504	0.645
0.62	0.85	-----	0.020	0.136	0.164	0.191	0.225	0.257	0.291	0.329	0.369	0.417	0.478	0.620
0.59	0.86	-----	-----	0.109	0.140	0.167	0.198	0.230	0.264	0.301	0.343	0.390	0.450	0.593
0.57	0.87	-----	-----	0.083	0.114	0.141	0.172	0.204	0.238	0.275	0.317	0.364	0.424	0.567
0.54	0.88	-----	-----	0.054	0.085	0.112	0.143	0.175	0.209	0.246	0.288	0.335	0.395	0.538
0.50	0.89	-----	-----	0.028	0.059	0.086	0.117	0.149	0.183	0.230	0.262	0.309	0.369	0.512
0.48	0.90	-----	-----	-----	0.030	0.058	0.089	0.121	0.155	0.192	0.234	0.281	0.341	0.484
0.46	0.91	-----	-----	-----	-----	0.030	0.060	0.093	0.127	0.164	0.205	0.253	0.313	0.456
0.43	0.92	-----	-----	-----	-----	-----	0.031	0.063	0.097	0.134	0.175	0.223	0.284	0.426
0.40	0.93	-----	-----	-----	-----	-----	-----	0.032	0.067	0.104	0.145	0.192	0.253	0.395
0.36	0.94	-----	-----	-----	-----	-----	-----	-----	0.034	0.071	0.112	0.160	0.220	0.363
0.33	0.95	-----	-----	-----	-----	-----	-----	-----	-----	0.037	0.078	0.126	0.186	0.329
0.29	0.96	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.041	0.089	0.149	0.292
0.25	0.97	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.048	0.108	0.251
0.20	0.98	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	0.061	0.203

Example:

Load power = 200 kW

Initial power factor, cos  $\phi$ 1 = 0.60

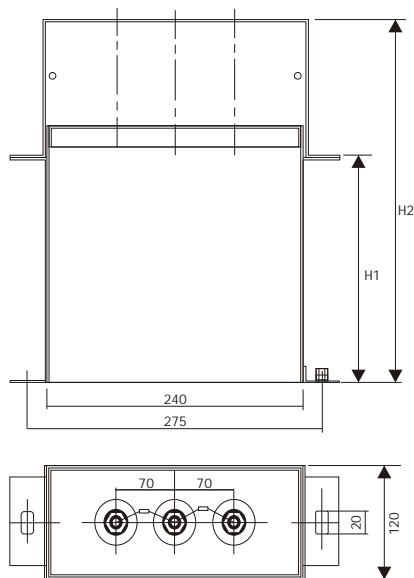
Desired power factor, cos  $\phi$ 2 = 0.90

It is required a power capacitor of  $200 \times 0.849 = 170$  kvar



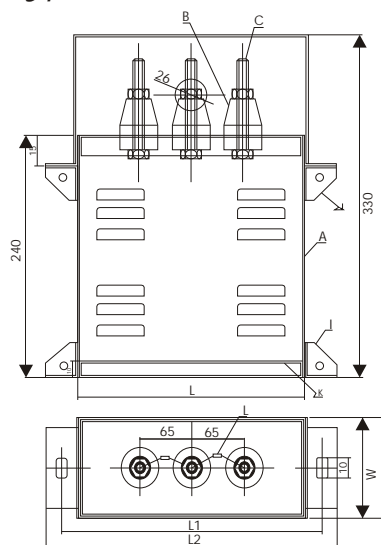
## L V Power Capacitor

### Type APP / MD 7.5-25 KVAR



KVAR	CURRENT	415 Volts				440 Volts				
		APP		MD		CURRENT	APP		MD	
		H1	H2	H1	H2		H1	H2	H1	H2
7.5	10.43	165	265	205	305	9.84	160	260	200	300
8	11.13	185	285	215	325	10.49	170	270	210	310
10	13.91	210	310	250	350	12.12	190	290	240	340
12.5	17.39	235	335	295	395	16.40	225	325	280	380
15	20.87	280	380	340	440	19.63	260	360	320	420
20	27.82	340	440	410	510	26.24	315	415	400	500
25	34.78	400	500	495	595	32.80	370	470	475	575

### Type MPP 10-25 KVAR



KVAR	L	L1	L2	W	No of MODULES	WEIGHT
10	240	270	300	80	3	3.6
12.5	240	270	300	80	3	3.6
15	310	340	370	135	6	5.7
20	310	340	370	135	6	6.5
25	310	340	370	135	6	7.2

GE offers widest range of capacitor switching contactor - Type CSC contactor. The CSC range is available for capacitor Switching application from 10 kVAR to 70 kVAR .



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