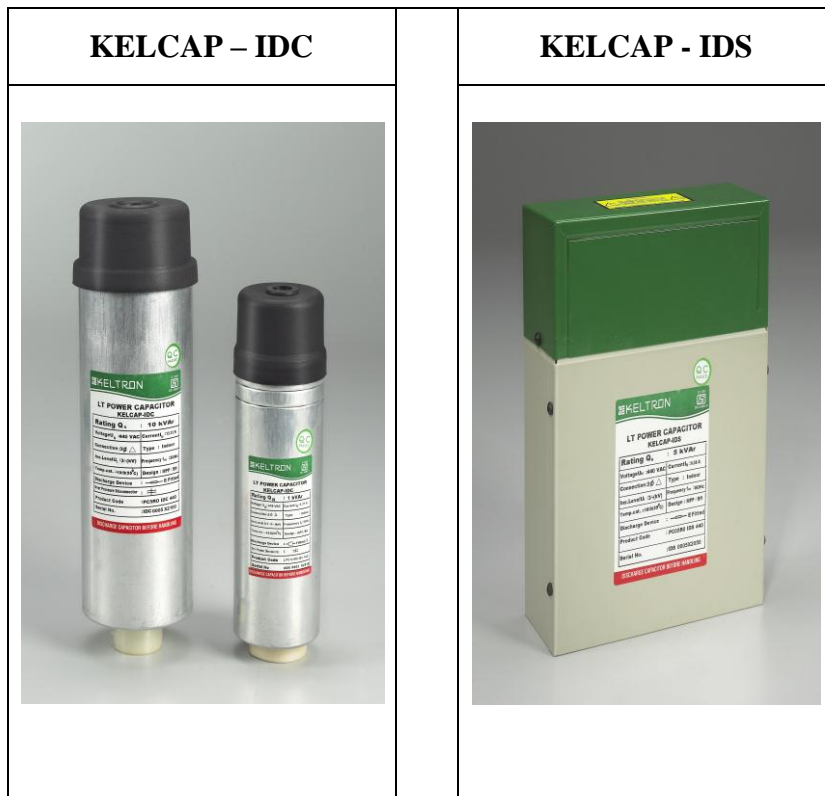




KELCAP – POWER CAPACITORS

INDUSTRIAL DUTY APPLICATION

POWER FACTOR CORRECTION IN SMALL SCALE INDUSTRIES, COMMERCIAL ESTABLISHMENTS, MACHINE SHOPS, PROCESS INDUSTRIES AND LIGHTING



KELTRON COMPONENT COMPLEX LIMITED

KELCAP – POWER CAPACITORS
KELCAP – IDC / KELCAP – IDS

KELTRON POWER CAPACITORS – SELF HEALING TYPE
FOR AC POWER SYSTEMS CONFIRMING TO INDIAN STANDARD IS 13340-1993

The need for improved power quality and reduction in energy cost is the order of the day. Every electrical load operating on the principle of magnetic field such as motors, chokes, transformers, welding sets, inductive heating and generators consume both reactive and active power. This scenario results in lower quality of power and reduced availability with lower capacity utilization and increased cost of generation. Keltron with the state of art latest technologies and extensive expertise has developed wide range of low tension power factor correction capacitors which offer simple and cost effective solution to improve power quality with reduction in energy cost.

CONSTRUCTIONAL FEATURES

Keltron power factor correction capacitor integrates MPP wound elements using self healing low loss MPP film. These dry sections are end sprayed with Zinc and are inserted into cans with filling of fire retardant resin and then cured. These cans are mounted inside metal enclosures with appropriate termination and discharge resistors. Industrial duty types are explosion proof designs with low wattage losses. The different types of industrial duty power factor correction capacitors are:

MODEL	SALIENT FEATURES
KELCAP-IDC	<ul style="list-style-type: none"> ➤ For standard duty application with cylindrical metal can construction. ➤ Provided with explosion proof design ➤ PF correction in low voltage/medium voltage networks, lighting, small scale industries, machine shops, process industries ➤ stud mounting ➤ Confirms to Indian Standard IS 13340-1993 ➤ MPP Self healing type/ with safety discharge resistor/over pressure cut off device/protection plastic cap ➤ ISI marked/ Low wattage losses
KELCAP-IDS	<ul style="list-style-type: none"> ➤ For standard duty application with square cap construction. ➤ Provided with explosion proof design ➤ PF correction in low voltage/medium voltage networks, lighting, small scale industries, machine shops, process industries ➤ stud mounting ➤ Confirms to Indian Standard IS 13340-1993 ➤ MPP Self healing type/ with safety discharge resistor/over pressure cut off device for 10 Kvar and above ➤ ISI marked/ Low wattage losses

I. KELCAP - IDC

POWER CAPACITOR – METALLIZED POLY PROPYLENE FILM SELF HEALING TYPE INDUSTRIAL DUTY – CYLINDRICAL CONSTRUCTION

KELCAP – IDC capacitors are industrial duty power factor correction capacitors of cylindrical aluminium can construction. Capacitors conform to Indian standard IS 13340 -1993. These capacitors are provided with explosion proof design. Mounting of capacitors are with the help of mounting stud. These capacitors are meant for standard duty PF correction in low voltage/medium voltage networks, lighting, small scale industries, machine shops and process industries with harmonics withstand capability of maximum 10%.

I.1) Technical specifications	
Voltage rating	440V/415V/3 phase/50Hz
Kvar rating	1 kvar – 25 kvar
Connection	Delta
Temperature class	-10 ⁰ C to +55 ⁰ C
Dielectric	MPP
Maximum over current	1.3 rated I
Peak inrush current	150 times rated I
Operational losses at dielectric level	≤ 0.20 W/kvar
Operational losses at termination including discharge resistor	≤ 0.45 W/kvar
Insulation level	3 KV
Installation	Indoor
Reference standard	IS 13340/1993, IS 13341/1992, IEC 60831-1(2002), IEC 60831-2(1995)
Mounting position	Any position except upside down
Mounting and earthing	Threaded stud
Protection and safety	Provided with over pressure cut off device, self healing, discharge resistors and protection plastic cap
Termination	1-9 kvar fast on ‘U’ terminal, 10-25 kvar screw type connection

I.2) Other Information		
Rating	Ordering code	Overall size with top cap in mm (Dia X Height)
1 kvar	PC01R0IDC440	65x220 (440V & 415V)
	PC01R0IDC415	
2 kvar	PC02R0IDC440	65x220 (440V & 415V)
	PC02R0IDC415	
3 kvar	PC03R0IDC440	65x220 (440V & 415V)
	PC03R0IDC415	
4 kvar	PC04R0IDC440	65x220 (440V & 415V)
	PC04R0IDC415	
5 kvar	PC05R0IDC440	72x220 (440V)
	PC05R0IDC415	75x220 (415V)
6 kvar	PC06R0IDC440	72x220 (440V)
	PC06R0IDC415	75x220 (415V)
7 kvar	PC07R0IDC440	72x265 (440V)
	PC07R0IDC415	75x265 (415V)
8 kvar	PC08R0IDC440	72x265 (440V)
	PC08R0IDC415	75x265 (415V)
9 kvar	PC09R0IDC440	85x255 (440V & 415V)
	PC09R0IDC415	
10 kvar	PC10R0IDC440	85x255 (440V & 415V)
	PC10R0IDC415	
12.5 kvar	PC12R5IDC440	85x340 (440V & 415V)
	PC12R5IDC415	
15 kvar	PC15R0IDC440	85x340 (440V & 415V)
	PC15R0IDC415	
20 kvar	PC20R0IDC440	85x415 (440V & 415V)
	PC20R0IDC415	
25 kvar	PC25R0IDC440	90x415 (440V & 415V)
	PC25R0IDC415	

II. KELCAP - IDS

POWER CAPACITOR – METALLIZED POLY PROPYLENE FILM SELF HEALING TYPE INDUSTRIAL DUTY – SQUARE CAP CONSTRUCTION

KELCAP – IDS capacitors are industrial duty power factor correction capacitors of square cap construction. Capacitors conform to Indian standard IS 13340 -1993. These capacitors are provided with explosion proof design. Mounting of capacitors are with the help of mounting stud. These capacitors are meant for standard duty PF correction in low voltage/medium voltage networks, lighting, small scale industries, machine shops and process industries with harmonics withstand capability of maximum 10%.

II.1) Technical specifications	
Voltage rating	440V/415V/3 phase/50Hz
Kvar rating	1 kvar – 25 kvar
Connection	Delta
Temperature class	-10 ⁰ C to +55 ⁰ C
Dielectric	MPP
Maximum over current	1.3 rated I
Peak inrush current	150 times rated I
Operational losses at dielectric level	≤ 0.20 W/kvar
Operational losses at termination including discharge resistor	≤ 0.45 W/kvar
Insulation level	3 KV
Installation	Indoor
Reference standard	IS 13340/1993, IS 13341/1992, IEC 60831-1(2002), IEC 60831-2(1995)
Mounting position	vertical
Mounting and earthing	Threaded stud
Protection and safety	Provided with over pressure cut off device for 10Kvar and above, self healing, discharge resistors
Termination	1-4 kvar: wire, 5-9 kvar: M6 terminal, 10-25 kvar: M8 terminal

II.2) Other Information		
Rating	Ordering code	Overall size with top cap in mm (Dia X Height)
1 kvar	PC01R0IDS440	55x155x90 WT (440V & 415V)
	PC01R0IDS415	
2 kvar	PC02R0IDS440	55x155x90 WT(440V & 415V)
	PC02R0IDS415	
3 kvar	PC03R0IDS440	60x170x115 WT (440V & 415V)
	PC03R0IDS415	
4 kvar	PC04R0IDS440	60x170x115 WT (440V & 415V)
	PC04R0IDS415	
5 kvar	PC05R0IDS440	60x170x(165+60) TT (440V & 415V)
	PC05R0IDS415	
6 kvar	PC06R0IDS440	65x185x(190+60) TT(440V & 415V)
	PC06R0IDS415	
7 kvar	PC07R0IDS440	65x185x(190+60) TT (440V & 415V)
	PC07R0IDS415	
8 kvar	PC08R0IDS440	65x185x(190+60) TT (440V & 415V)
	PC08R0IDS415	
9 kvar	PC09R0IDS440	85x(250+60)x(250+85) TT(440V & 415V)
	PC09R0IDS415	
10 kvar	PC10R0IDS440	85x(250+60)x(250+85) TT (440V & 415V)
	PC10R0IDS415	
12.5 kvar	PC12R5IDS440	85x(250+60)x(250+85) TT (440V & 415V)
	PC12R5IDS415	
15 kvar	PC15R0IDS440	85x(250+60)x(250+85) TT (440V & 415V)
	PC15R0IDS415	
20 kvar	PC20R0IDS440	170x(250+60)x(250+85) TT (440V & 415V)
	PC20R0IDS415	
25 kvar	PC25R0IDS440	170x(250+60)x(250+85) TT (440V & 415V)
	PC25R0IDS415	

RECOMMENDED CAPACITOR RATING FOR DIRECT CONNECTION TO INDUCTION MOTORS

(For improvement of power factor to 0.95 or better)

Motor rating in HP	Capacitor rating in Kvar when motor speed in RPM is:						Motor rating in HP	Capacitor rating in Kvar when motor speed in RPM is:					
	3000	1500	1000	750	600	500		3000	1500	1000	750	600	500
2.5	1	1	1.5	2	2.5	2.5	105	22	24	27	29	36	41
5	2	2	2.5	3.5	4	4	110	23	25	28	30	38	43
7.5	2.5	3	3.5	4.5	5	5.5	115	24	26	29	31	39	44
10	3	4	4.5	5.5	6	6.5	120	25	27	30	32	40	46
12.5	3.5	4.5	5	6.5	7.5	8	125	26	28	31	33	41	47
15	4	5	6	7.5	8.5	9	130	27	29	32	34	43	49
17.5	4.5	5.5	6.5	8	10	10.5	135	28	30	33	35	44	50
20	5	6	7	9	11	12	140	29	31	34	36	46	52
22.5	5.5	6.5	8	10	12	13	145	30	32	35	37	47	54
25	6	7	9	10.5	13	14.5	150	31	33	36	38	48	55
27.5	6.5	7.5	9.5	11.5	14	16	115	32	34	37	39	49	56
30	7	8	10	12	15	17	160	33	35	38	40	50	57
32.5	7.5	8.5	11	13	16	18	165	34	36	39	41	51	59
35	8	9	11.5	13.5	17	19	170	35	37	40	42	53	60
37.5	8.5	9.5	12	14	18	20	175	36	38	41	43	54	61
40	9	10	13	15	19	21	180	37	39	42	44	55	62
42.5	9.5	11	14	16	20	22	185	38	40	43	45	56	63
45	10	11.5	14.5	16.5	21	23	190	38	40	43	45	58	65
47.5	10.5	12	15	17	22	24	195	39	41	44	46	59	66
50	11	12.5	16	18	23	25	200	40	42	45	47	60	67
55	12	13.5	17	19	24	26	205	41	43	46	48	61	68
60	13	14.5	18	20	26	28	210	42	44	47	49	61	69
65	14	15.5	19	21	27	29	215	42	44	47	49	62	70
70	15	16.5	20	22	28	31	220	43	45	48	50	63	71
75	16	17	21	23	29	32	225	44	46	49	51	64	72
80	17	19	22	24	30	34	230	45	47	50	52	65	73
85	18	20	23	25	31	35	235	46	48	51	53	65	74
90	19	21	24	26	33	37	240	46	48	51	53	66	75
95	20	22	25	27	34	38	245	47	49	52	54	67	75
100	21	23	26	28	35	40	250	48	50	53	55	68	76

RECOMMENDED CABLE SIZE, HRC FUSES AND CONTACTOR RATINGS FOR USE WITH DIFFERENT KVAR RATING CAPACITORS

Unit Rating (Kvar)	Rated current @ Rated voltage (A)		Recommended				Unit rating (Kvar)	Rated current @ Rated voltage (A)		Recommended			
	415V Rated volt	440V Rated volt	Cable size (sq.mm)		HRC fuse Rating (A)	Contactor* Rating (A)		415V Rated volt	440V Rated volt	Cable size (sq.mm)		HRC fuse Rating (A)	Contactor* Rating (A)
			Cu.	Al.						Cu.	Al.		
1	1.39	1.31	0.75	1.5	4	9	8	11.13	10.50	2.50	4	20	32
2	2.78	2.62	0.75	1.5	6	9	9	12.52	11.81	4	6	25	32
3	4.17	3.94	1	1.5	10	12	10	13.91	13.12	4	6	25	32
4	5.56	5.25	1	1.5	10	12	12.5	17.39	16.40	6	10	32	40
5	6.96	6.56	1.5	2.5	16	16	15	20.87	19.68	10	16	40	63
6	8.35	7.87	2.5	2.5	16	22	20	27.82	26.24	10	16	50	63
7	9.74	9.19	2.50	4	20	22	25	34.78	32.80	16	25	63	63
7.5	10.43	9.84	2.5	4	20	22	30	41.74	39.36	25	35	80	85

SELECTION GUIDELINE FOR REACTIVE COMPENSATION

Multiplying factor for calculating required capacitor rating

Initial PF	Target PF									
	0.70	0.75	0.80	0.85	0.87	0.90	0.92	0.95	0.97	1.00
0.30	2.15	2.29	2.43	2.56	2.61	2.70	2.75	2.85	2.93	3.18
0.35	1.66	1.80	1.93	2.05	2.11	2.19	2.25	2.35	2.43	2.68
0.40	1.27	1.41	1.54	1.67	1.72	1.81	1.87	1.96	2.04	2.29
0.45	0.96	1.10	1.23	1.36	1.42	1.50	1.56	1.66	1.73	1.98
0.50	0.71	0.85	0.98	1.11	1.17	1.25	1.31	1.40	1.48	1.73
0.52	0.62	0.76	0.89	1.02	1.08	1.15	1.22	1.31	1.39	1.64
0.54	0.54	0.68	0.81	0.94	0.99	1.07	1.13	1.23	1.31	1.56
0.55	0.50	0.64	0.77	0.90	0.95	1.03	1.09	1.19	1.27	1.52
0.56	0.46	0.60	0.73	0.86	0.91	1.00	1.05	1.15	1.23	1.48
0.58	0.38	0.52	0.65	0.78	0.84	0.92	0.98	1.08	1.15	1.40
0.60	0.31	0.45	0.58	0.71	0.77	0.85	0.91	1.00	1.08	1.33
0.62	0.25	0.38	0.52	0.65	0.70	0.78	0.84	0.94	1.01	1.27
0.64	0.18	0.32	0.45	0.58	0.63	0.72	0.77	0.87	0.95	1.20
0.65	0.15	0.29	0.42	0.55	0.60	0.68	0.74	0.84	0.92	1.17
0.66	0.12	0.26	0.39	0.52	0.57	0.65	0.71	0.81	0.89	1.14
0.68	0.06	0.20	0.33	0.46	0.51	0.59	0.65	0.75	0.83	1.08
0.70		0.14	0.27	0.40	0.45	0.54	0.59	0.69	0.77	1.02
0.72		0.08	0.21	0.34	0.40	0.48	0.54	0.63	0.71	0.96
0.74		0.03	0.16	0.29	0.34	0.42	0.48	0.58	0.66	0.91
0.75			0.13	0.26	0.32	0.40	0.46	0.55	0.63	0.88
0.76			0.11	0.24	0.29	0.37	0.43	0.53	0.60	0.86
0.78			0.05	0.18	0.24	0.32	0.38	0.47	0.55	0.80
0.80				0.13	0.18	0.27	0.32	0.42	0.50	0.75
0.82				0.08	0.13	0.21	0.27	0.37	0.45	0.70
0.84				0.03	0.08	0.16	0.22	0.32	0.40	0.65
0.85					0.05	0.14	0.19	0.29	0.37	0.62
0.86					0.03	0.11	0.17	0.26	0.34	0.59
0.88						0.06	0.11	0.21	0.29	0.54
0.90							0.06	0.16	0.23	0.48
0.92								0.10	0.18	0.43
0.94								0.03	0.11	0.36
0.95									0.08	0.32
0.96									0.04	0.29
0.98										0.20
1.00										0.00

KVAR selection guideline:

Consider an industrial load 500KW at 0.85 PF lag. For improving the power factor of the system to 0.95 PF

- Actual power : 500KW
- Target Cos Ø : 0.95
- Initial Cos Ø : 0.85
- Multiplying factor K from the table : 0.29

Required reactive power Qc= 500 X 0.29 = 145 Kvar

GUIDELINES FOR INSTALLATION

- 1) Preferably capacitor must be installed in vertical position.
- 2) Installed area should be free from water, vermin dust oil and chemical.
- 3) Capacitor body should be earthed at two different positions.
- 4) SFU/MCB/MCCB is recommended for short circuit protection.
- 5) Capacitor should be installed in a cross ventilated area only.
- 6) Current rating of the cable should be minimum 1.8 times capacitor current.
- 7) Appropriate size of lugs should be used for connecting cable to terminals and tightened fully.

OPERATIONAL GUIDELINES

- 1) Avoid touching the terminals of a charged capacitor.
- 2) Do not short circuit the terminals of a capacitor.
- 3) Ensure proper earthing of capacitors before energizing the unit.
- 4) HRC fuses/MCB/MCCB of proper current rating are recommended to be installed in SERIES with power capacitors to avoid over current driving through the units.
- 5) Ensure proper tightening of cables connected to the capacitor terminals to avoid heating up at terminations.
- 6) Ensure proper selection of capacitors depending upon harmonic distortion in the electrical system and in case if the distortion is high harmonic filters may be employed to limit the current through the power capacitor.
- 7) Connect capacitors to the system when the inductive load is switched on and ensure proper compensation as per selection guideline for power factor improvement.

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