CATALOGUE

POWER FACTOR CORRECTION

legrand®

LIVE THE ADVANTAGE

Contents

POWER FACTOR CORRECTION

An AC electrical installation incorporating receivers such as transformers, motors, fluorescent tube ballasts or any other receivers whose current is phase-shifted in relation to the voltage, consumes reactive energy.

This reactive energy (expressed in kilovar-hours – kVArh) is billed in the same way as active energy by energy suppliers. Reactive energy therefore results in more power being used and thus contributes to higher electricity bills.

POWER FACTOR

By definition, the power factor of an electrical installation (PF) is equal to the active power P (kW) over the apparent power S (kVA).

PF = P (kW)/S(kVA)

Usually PF ≃ Cos φ

a good power factor is:
- high cos φ (close to 1)
- or low tg φ (close to 0)

A power factor of 1 will result in no reactive energy consumption and vice versa.

Energy metering devices record active and reactive energy consumption. Electricity suppliers generally use the term tg φ on their bills.

Cos φ and tg φ are linked by the following equation:

$$\text{Cos } \varphi = \frac{1}{\sqrt{1 + (\text{tg } \varphi)^2}}$$

ADVANTAGES

By supplying reactive energy on demand, ALPX³ capacitor banks allow the subscriber to do the following:

1. Increase the power available to the distribution transformers

EXAMPLE

For a 1000 kVAr transformer with cos φ = 0.75 and a 750 kW installation: by increasing the cos φ to 0.96 a further 210 kW can be gained (+28%).

Correlation between power factor/gain in available power

Level of power factor cos φ	Additional power available to the transformer
0.8	+7%
0.85	+13%
0.9	+20%
0.96	+28%
1	+33%

2. Limit energy losses in the cables by the Joule effet (limiting voltage drops) given the decrease in the current carried in the installation

EXAMPLE

For a 1000 kVA transformer with cos φ =0.75 and a 750 kW installation: by increasing the cos φ to 0.96, we get a reduction in current of around 22%.

3. Achieve energy savings regardless of the type of electricity supplier contract.

- Installing a capacitor bank allows users to:
- **save energy**
- **avoid the penalties** applied by the electricity supplier or
- **optimise the electricity contract**

OPERATING PRINCIPLE

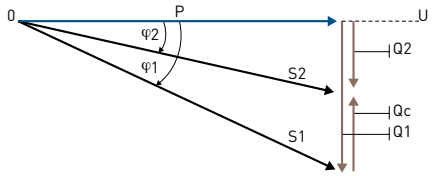
Capacitor banks improve the power factor of an electrical installation by giving it a proportion of the reactive energy it consumes.

The capacitor is a receiver made up of two conductive parts (electrodes) separated by an insulator. When this receiver is subjected to a sinusoidal voltage, it shifts its current, and hence its power (capacitive reactive), by 90° ahead of the voltage.
Conversely, all other receivers (motors, transformers, etc.) shift their reactive component (current or inductive reactive power) by 90° behind the voltage.

The vectorial composition of these currents or reactive powers (inductive and capacitive) gives a reactive resultant current or power below the value which existed before the capacitors were installed.

In simple terms, it is said that inductive receivers (motors, transformers, etc.) consume reactive energy whereas capacitors (capacitive receivers) produce reactive energy.

Power diagram



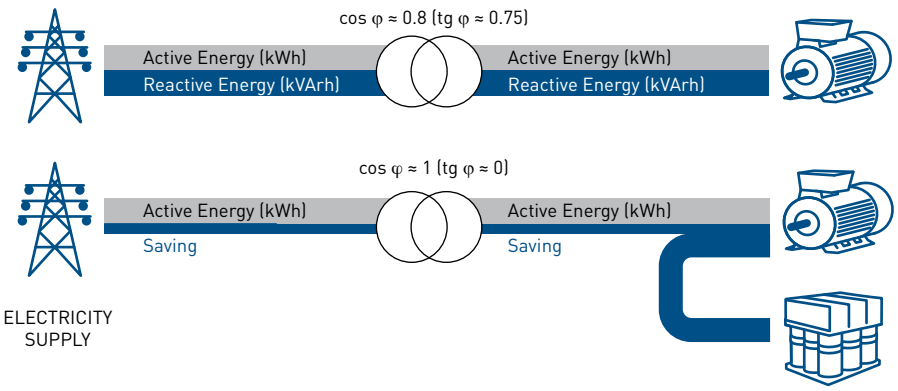
P: Active power
S1 and S2: apparent powers (before and after compensation)
Qc: capacitor reactive power
Q1: reactive power without capacitor
Q2: reactive power with capacitor

Equations

$Q2 = Q1 - Qc$
$Qc = Q1 - Q2$
$Qc = P.tg\ \varphi\ 1 - P.tg\ \varphi\ 2$

$Qc = P(tg\ \varphi\ 1 - tg\ \varphi\ 2)$

φ 1 phase shift without capacitor
φ 2 phase shift with capacitor



DETERMINING THE LV POWER FACTOR CORRECTION SOLUTION

In a low voltage electrical installation, determining the power factor correction solution requires several stages as follows:

STEP 1 Determining the capacitor power (kVAr) to compensate for the reactive energy required for the installation

STEP 2 Determining the general configuration
- Global compensation for the whole installation
- Compensation for each sector
- Individual compensation in high power loads

STEP 3 Determining the compensation mode
- Fixed compensation for stable load
- Automatic compensation for variable or unstable load
- Dynamic compensation for very unstable load

STEP 4 Determining the capacitor bank type according to the level of harmonics
- Identify the level of harmonic pollution by THDi –THDu measurements or if necessary (eg: new installation) by estimating the percentage of "non-linear loads" (SH/ST)

STEP 1

DETERMINING THE CAPACITOR POWER IN KVAR

To determine the capacitor power (kVAr) to compensate for the reactive energy required for the installation, use one of the following methods:

- Measurement of the reactive power and Cos φ with measurement control units.
- Analysis of the electricity supplier's bills according to the subscription type (subscribed demand, reactive energy billed in kVArh and tg φ).
- In the context of future installations, compensation is frequently required right from the commissioning stage. In this case, it is not possible to calculate the capacitor bank using conventional methods (electricity bill).

For this type of installation, we recommend installing a capacitor bank with approximately **25% of the nominal power of the corresponding HV/LV transformer.**

EXAMPLE

1000 kVA transformer, capacitor Q = 250 kVAr

NB: This type of ratio corresponds to the following operating conditions:
- 1000 kVA transformer
- Actual transformer load = 75%
- Cos φ of the load = 0.80 } k = 0.421
- Cos φ to be obtained = 0.95 } (see table on opposite page)

Qc = 1000 x 75% x 0.80 x 0.421 = 250 kvar

- Estimated total amount of reactive energy needed for all receivers in the installation, especially motors and transformers depending on the manufacturer's data.

Initial power factor		Capacitor power to be installed, in kvar per kW of load, to increase the power factor to cos φ_2:										
cos φ_1	tg φ_1	cos φ_2:	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1
		tg φ_2:	0.48	0.46	0.43	0.40	0.36	0.33	0.29	0.25	0.20	0.14	0.0
0.40	2.29		1.805	1.832	1.861	1.895	1.924	1.959	1.998	2.037	2.085	2.146	2.288
0.41	2.22		1.742	1.769	1.798	1.831	1.840	1.896	1.935	1.973	2.021	2.082	2.225
0.42	2.16		1.681	1.709	1.738	1.771	1.800	1.836	1.874	1.913	1.961	2.002	2.164
0.43	2.10		1.624	1.651	1.680	1.713	1.742	1.778	1.816	1.855	1.903	1.964	2.107
0.44	2.04		1.558	1.585	1.614	1.647	1.677	1.712	1.751	1.790	1.837	1.899	2.041
0.45	1.98		1.501	1.532	1.561	1.592	1.626	1.659	1.695	1.737	1.784	1.846	1.988
0.46	1.93		1.446	1.473	1.502	1.533	1.567	1.600	1.636	1.677	1.725	1.786	1.929
0.47	1.88		1.397	1.425	1.454	1.485	1.519	1.532	1.588	1.629	1.677	1.758	1.881
0.48	1.83		1.343	1.730	1.400	1.430	1.464	1.467	1.534	1.575	1.623	1.684	1.826
0.49	1.78		1.297	1.326	1.355	1.386	1.420	1.453	1.489	1.530	1.578	1.639	1.782
0.50	1.73		1.248	1.276	1.303	1.337	1.369	1.403	1.441	1.481	1.529	1.590	1.732
0.51	1.69		1.202	1.230	1.257	1.291	1.323	1.357	1.395	1.435	1.483	1.544	1.686
0.52	1.64		1.160	1.188	1.215	1.249	1.281	1.315	1.353	1.393	1.441	1.502	1.644
0.53	1.60		1.116	1.144	1.171	1.205	1.237	1.271	1.309	1.349	1.397	1.458	1.600
0.54	1.56		1.075	1.103	1.130	1.164	1.196	1.230	1.268	1.308	1.356	1.417	1.559
0.55	1.52		1.035	1.063	1.090	1.124	1.156	1.190	1.228	1.268	1.316	1.377	1.519
0.56	1.48		0.996	1.024	1.051	1.085	1.117	1.151	1.189	1.229	1.277	1.338	1.480
0.57	1.44		0.958	0.986	1.013	1.047	1.079	1.113	1.151	1.191	1.239	1.300	1.442
0.58	1.40		0.921	0.949	0.976	1.010	1.042	1.073	1.114	1.154	1.202	1.263	1.405
0.59	1.37		0.884	0.912	0.939	0.973	1.005	1.039	1.077	1.117	1.165	1.226	1.368
0.60	1.33		0.849	0.878	0.905	0.939	0.971	1.005	1.043	1.083	1.131	1.192	1.334
0.61	1.30		0.815	0.843	0.870	0.904	0.936	0.970	1.008	1.048	1.096	1.157	1.299
0.62	1.27		0.781	0.809	0.836	0.870	0.902	0.936	0.974	1.014	1.062	1.123	1.265
0.63	1.23		0.749	0.777	0.804	0.838	0.870	0.904	0.942	0.982	1.030	1.091	1.233
0.64	1.20		0.716	0.744	0.771	0.805	0.837	0.871	0.909	0.949	0.997	1.058	1.200
0.65	1.17		0.685	0.713	0.740	0.774	0.806	0.840	0.878	0.918	0.966	1.007	1.169
0.66	1.14		0.654	0.682	0.709	0.743	0.775	0.809	0.847	0.887	0.935	0.996	1.138
0.67	1.11		0.624	0.652	0.679	0.713	0.745	0.779	0.817	0.857	0.905	0.966	1.108
0.68	1.08		0.595	0.623	0.650	0.684	0.716	0.750	0.788	0.828	0.876	0.937	1.079
0.69	1.05		0.565	0.593	0.620	0.654	0.686	0.720	0.758	0.798	0.840	0.907	1.049
0.70	1.02		0.536	0.564	0.591	0.625	0.657	0.691	0.729	0.796	0.811	0.878	1.020
0.71	0.99		0.508	0.536	0.563	0.597	0.629	0.663	0.701	0.741	0.783	0.850	0.992
0.72	0.96		0.479	0.507	0.534	0.568	0.600	0.634	0.672	0.721	0.754	0.821	0.963
0.73	0.94		0.452	0.480	0.507	0.541	0.573	0.607	0.645	0.685	0.727	0.794	0.936
0.74	0.91		0.425	0.453	0.480	0.514	0.546	0.580	0.618	0.658	0.700	0.767	0.909
0.75	0.88		0.398	0.426	0.453	0.487	0.519	0.553	0.591	0.631	0.673	0.740	0.882
0.76	0.86		0.371	0.399	0.426	0.460	0.492	0.526	0.564	0.604	0.652	0.713	0.855
0.77	0.83		0.345	0.373	0.400	0.434	0.466	0.500	0.538	0.578	0.620	0.687	0.829
0.78	0.80		0.319	0.347	0.374	0.408	0.440	0.474	0.512	0.552	0.594	0.661	0.803
0.79	0.78		0.292	0.320	0.347	0.381	0.413	0.447	0.485	0.525	0.567	0.634	0.776
0.80	0.75		0.266	0.294	0.321	0.355	0.387	0.421	0.459	0.499	0.541	0.608	0.750
0.81	0.72		0.240	0.268	0.295	0.329	0.361	0.395	0.433	0.473	0.515	0.582	0.724
0.82	0.70		0.214	0.242	0.269	0.303	0.335	0.369	0.407	0.447	0.489	0.556	0.698
0.83	0.67		0.188	0.216	0.243	0.277	0.309	0.343	0.381	0.421	0.463	0.530	0.672
0.84	0.65		0.162	0.190	0.217	0.251	0.283	0.317	0.355	0.395	0.437	0.504	0.645
0.85	0.62		0.136	0.164	0.191	0.225	0.257	0.291	0.329	0.369	0.417	0.478	0.602
0.86	0.59		0.109	0.140	0.167	0.198	0.230	0.264	0.301	0.343	0.390	0.450	0.593
0.87	0.57		0.083	0.114	0.141	0.172	0.204	0.238	0.275	0.317	0.364	0.424	0.567
0.88	0.54		0.054	0.085	0.112	0.143	0.175	0.209	0.246	0.288	0.335	0.395	0.538
0.89	0.51		0.028	0.059	0.086	0.117	0.149	0.183	0.230	0.262	0.309	0.369	0.512
0.90	0.48			0.031	0.058	0.089	0.121	0.155	0.192	0.234	0.281	0.341	0.484

For example: 200 kW motor - cos φ_1 = 0.75 - cos φ_2 desired = 0.93 - Qc = 200 x 0.487 = 98 kVAr

The table opposite can be used to calculate the capacitor power in order to switch from an initial power factor to a desired power factor based on the receiver power in kW. It also gives the equivalence between cos φ and tg φ.

DETERMINING THE POWER FACTOR CORRECTION SOLUTION (continued)

STEP 2

DETERMINING THE GENERAL CONFIGURATION

Depending on the installation architecture, the location and power of the receivers consuming reactive energy, the following are possible:

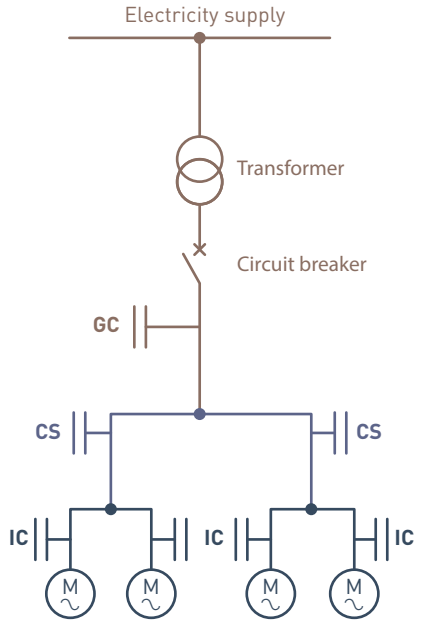
GLOBAL COMPENSATION in the main LV distribution board > choose an automatic or dynamic bank

COMPENSATION BY EACH SECTOR in the secondary distribution boards, for example: workshop secondary distribution board > choose an automatic or dynamic bank

INDIVIDUAL COMPENSATION as close as possible to the load consuming the reactive energy (depending on variation in the loads a fixed bank,

EXAMPLE

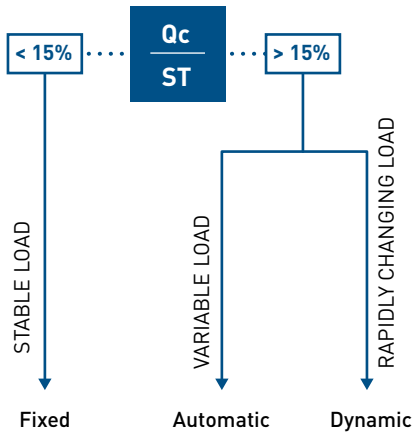
Compensating reactive energy at the terminals of a motor by a fixed capacitor bank controlled at the same time as the motor



GC = Global compensation
CS = Compensation by sector
IC = Individual compensation
M = Typical motor load

STEP 3

DETERMINING THE COMPENSATION MODE



QC = Power of the compensation system in kVar

ST = Power of the MV/LV transformer in kVA (or MV/LV transformers if there are two or more transformers in parallel)

	GLOBAL COMPENSATION	COMPENSATION BY EACH SECTOR	INDIVIDUAL COMPENSATION
ADVANTAGES	▸ No billing of reactive energy ▸ Increased power available at the transformer secondary ▸ Most economical solution	▸ No billing of reactive energy ▸ Reduction of losses along the line between transformer and mains secondary distribution boards ▸ Economical solution	▸ No billing of reactive energy ▸ Reduction of losses along the whole line between transformer and the load ▸ Power factor correction as close as possible to the devices consuming reactive energy
COMMENTS	▸ No reduction in losses along the line (voltage dips for loads a long way from the capacitor bank) ▸ No savings in terms of sizing electrical equipment	▸ Solution generally used for very extensive factory networks	▸ Most expensive solution given the high number of installations

STEP 4

DETERMINING THE CAPACITOR BANK TYPE ACCORDING TO THE LEVEL OF HARMONICS

For supplies with a high level of harmonic pollution, Legrand recommends capacitor banks with detuned reactors.

The detuned reactor performs a threefold role:

- Increasing the capacitor impedance in relation to the harmonic currents
- Shifting the parallel resonance frequency (Fr.p) of the source and capacitor to below the main frequencies of the harmonic currents that are causing interference.

Tuning frequency (Hz)	Blocking factor (P%)	Tuning number (n)
189	7	3.78
135	14	2.7

- Helping to reduce harmonic levels in the supply.

The table opposite can be used to select the capacitor bank type according to the degree of harmonic pollution, by measuring the percentage of THDi and THDu or by estimating the percentage total power of SH/ST non-linear loads.

Measurements		Estimates	Type of capacitor to be used	Reactor to be used
THDU %	THDI %	SH/ST %		
⩽ 3	⩽ 10	⩽ 15	Standard Duty	-
⩽ 4	⩽ 15	⩽ 25	Heavy Duty	-
⩽ 6	⩽ 30	⩽ 35	Standard Duty	7% Reactor *14% Reactor if high level of 3rd order harmonics
⩽ 8	⩽ 40	⩽ 50	Heavy Duty	7% Reactor

SH (kVA) is the weighted total power of the harmonic generators present at the transformer secondary.

ST (kVA) is the power rating of the HV/LV transformer.

THDi = Total Harmonic Distortion (THD) is the ratio of the rms value of the harmonic currents In of the order n to the rms value of the fundamental.

THDu = Voltage Distortion (THDu) is caused mainly by the high level of Current Distortion (THDi) and the level of THDu is dependent on the source impedance.

* for example if -
- Ih5 > 0.2x145
- Ih3 : 3rd order harmonic currents
- Ih5 : 5th order harmonic currents

Alpx³ capacitors

The Alpx³ range of capacitors includes:

- Resin filled capacitors
  - Can type standard duty
  - Can type Heavy duty
  - Box type standard duty
  - Box type heavy duty
- Detuned reactor
- Controller

FEATURES

Safety

In the event of thermal or electrical overload, the electrical breakdown occurs. During such event the gases released from di-electric film accumulate in the can. This forms a high pressure inside the can. A specially designed internal mechanism breaks the fuse and the capacitor is disconnected from the circuit. Thus the overpressure dis-connector protects the capacitor.

Alpx³ capacitors

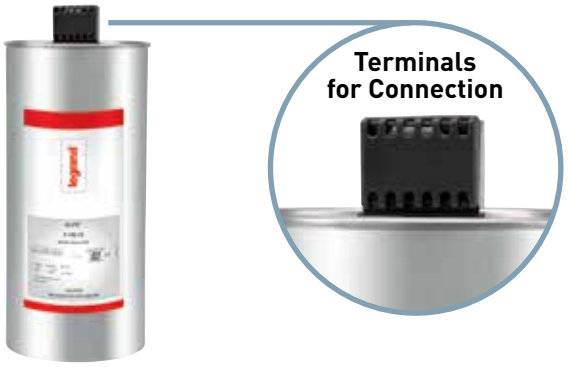
FEATURES

Self-healing technology for a longer life

In case of voltage breakdown the metal layer around the breakdown evaporates. This process happens in microseconds. This results in perfect isolation of the faulty area within microseconds. An insulation area is formed which is resistive and voltage proof, keeping the capacitor operational with a negligible loss of capacitance. The capacitor remains operational during the entire process.

Built-in terminal connectors

Our built-in terminal connectors offer ease of termination of cables to the capacitors.



Compact design

Alpx³ is constructed with three single elements stacked and assembled to form a delta connection. The compact design offers high mechanical strength and stability. This makes installation sturdy and ensures longer life to the system. Also, the compact shape of the product makes handling easy.

FEATURES

Ease of installation

Compact cylindrical design of Alpx³ makes installation easy & faster. The reduced installation time and cost makes a perfect combination for the installer. Mounting is done with a stud at the bottom of the capacitor. The stud forms a solid permanent earthing.

Stable performance

Design and manufacturing processes make Alpx³ capacitance stable over a long period of time and makes installation error free

Better heat dissipation

The Aluminium can design makes heat dissipation uniform.

Low energy loss (energy saving)

Alpx³ is designed and made for long life and low losses during the operation. Thus making it one of the most energy efficient capacitors.

Alpx³

Resin filled can type capacitors

5150 04 5150 06 5150 08 5150 23

Conforms to IS 13340-1&2, IEC 60831-1&2
ISI marked
Compact design
Self healing metallized polypropylene film
Over pressure device for disconnection
Low energy losses
Resistance to high temperatures
Resin filled

Pack	Cat.Nos	Standard duty 440 V
		Rating
1/12	5150 00	1 kVAr
1/12	5150 01	2 kVAr
1/12	5150 02	3 kVAr
1/12	5150 03	4 kVAr
1/12	5150 04	5 kVAr
1/6	5150 05	7.5 kVAr
1/4	5150 06	10 kVAr
1/4	5150 07	12.5 kVAr
1/4	5150 08	15 kVAr
1/4	5150 09	20 kVAr
1/4	5150 10	25 kVAr
1/4	5150 11	30 kVAr

		Heavy duty 440 V
		Rating
1/12	5150 12	1 kVAr
1/12	5150 13	2 kVAr
1/12	5150 14	3 kVAr
1/12	5150 15	4 kVAr
1/6	5150 16	5 kVAr
1/4	5150 17	7.5 kVAr
1/4	5150 18	10 kVAr
1/4	5150 19	12.5 kVAr
1/4	5150 20	15 kVAr
1/4	5150 21	20 kVAr
1/2	5150 22	25 kVAr
1/2	5150 23	30 kVAr

		Standard duty 480 V
		Rating
1/6	5150 24	4.2 kVAr
1/4	5150 25	6.9 kVAr
1/4	5150 26	8.7 kVAr
1/4	5150 27	20.4 kVAr
1/4	5150 28	14 kVAr
1/4	5150 29	17.4 kVAr
1/4	5150 30	20.8 kVAr

		Standard duty 525 V
		Rating
1/6	5150 31	5 kVAr
1/4	5150 32	8.3 kVAr
1/4	5150 33	10.4 kVAr
1/4	5150 34	12.5 kVAr
1/4	5150 35	16.7 kVAr
1/4	5150 36	20.8 kVAr
1/4	5150 37	25 kVAr

Alpx³

Resin filled box type capacitors

5150 47 5150 61

Conforms to IS 13340-1&2, IEC 60831-1&2
ISI marked
Compact design
Self healing metallized polypropylene film
Low energy losses
Resistance to high temperatures
Resin filled

Pack	Cat.Nos	Standard duty 440 V
		Rating
1/4	5150 40	1 kVAr
1/4	5150 41	2 kVAr
1/4	5150 42	3 kVAr
1/4	5150 43	4 kVAr
1	5150 44	5 kVAr
1	5150 45	7.5 kVAr
1	5150 46	8.33 kVAr
1	5150 47	10 kVAr
1	5150 48	12.5 kVAr
1	5150 49	15 kVAr
1	5150 50	20 kVAr
1	5150 51	25 kVAr
1	5150 52	50 kVAr

		Heavy duty 440 V
		Rating
1	5150 53	5 kVAr
1	5150 54	7.5 kVAr
1	5150 55	8.33 kVAr
1	5150 56	10 kVAr
1	5150 57	12.5 kVAr
1	5150 58	15 kVAr
1	5150 59	20 kVAr
1	5150 60	25 kVAr
1	5150 61	50 kVAr

Alpican™

gas filled capacitors

4151 29

- Conforms to IS 13340-1993 IEC 60831-1&2
- ISI marked
- Metalized polypropylene film
- Explosion proof design
- Better heat dissipation
- Low losses
- Range:

  Gas filled - 5 to 25 KVAr

Pack	Cat.Nos	**Heavy duty gas filled capacitor 440 V, 3 phase, 50 Hz**
1/4	4151 24	5.2 KVAr
1/4	4151 25	7.3 KVAr
1/4	4151 26	8.8 KVAr
1/4	4151 27	10.5 KVAr
1/4	4151 28	12.6 KVAr
1/4	4151 29	17.5 KVAr
1/4	4151 30	21 KVAr
1/4	4151 31	25.2 KVAr

Reactors and power factor controller

5151 00

4151 95

Pack	Cat.Nos	**Detuned reactors**
		High harmonic loading capacity Low losses High linearity Easy mounting
		Rating
1	4151 48	Reactor 10 kVAr 7%
1	4151 49	Reactor 12.5 kVAr 7%
1	4151 50	Reactor 25 kVAr 7%
1	4151 51	Reactor 50 kVAr 7%
1	4151 52	Reactor 100 kVAr 7%
1	4151 53	Reactor 12.5 kVAr 14%
1	4151 54	Reactor 25 kVAr 14%
1	4151 55	Reactor 50 kVAr 14%

		Power factor controller Eco
		Conforms to IEC 61010-1 High accuracy IP 41 terminals Manual & Automatic mode of operation Free potential contact for remote alarm Displays alarm indication for 9 different conditions
		Rating
1	4151 95	4 Step
1	4151 96	6 Step
1	4151 97	8 Step
1	4151 98	12 Step

FRONT-MOUNTING BLOCK FOR SWITCHING CAPACITORS

FRONT-MOUNTING BLOCK FOR SWITCHING CAPACITORS

Auxiliary blocks for switching capacitors are installed directly on CTX³ 3-pole, 9 to 100 A contactors. With their discharge resistors, they reduce current peaks during switching of capacitor banks.

With the wide range of accessories, CTX³ contactors can be used in a wide variety of applications:
- Switching capacitor banks
- Supply inverter
- Reversing contactor
- Time-delay motor starter
- Control unit on machine, etc.

Alpx³

resin filled standard duty and heavy duty capacitors

Technical specifications

Sr. No.	Specifications	Resin filled Can Type		Resin filled Box Type	
		Standard Duty	Heavy duty	Standard Duty	Heavy duty
1	Standards	IS 13340 (Part 1&2):2012			
		IEC 60831-1&2 : 2002			
2	Rated Voltage	440 V, 480 V & 525 V	440 V	440 V	440 V
3	Frequency	50/60 Hz			
4	Power range	1 to 30 kVAr	1 to 30 kVAr	1 to 50 kVAr	5 to 50 kVAr
5	Losses (Dielectric)	< 0.20 W/kVAr			
6	Losses (Total)	< 0.5 W/kVAr			
7	Peak inrush current	200*In	250*In	200*In	250*In
8	Over voltage	UN+10% for 8 Hrs in 24 Hrs	UN+10% for 8 Hrs in 24 Hrs	UN+10% for 8 Hrs in 24 Hrs	UN+10% for 8 Hrs in 24 Hrs
9	Over current	Upto 1.5*In	Upto 1.8*In	Upto 1.5*In	Upto 1.8*In
10	Mean life expectancy	upto 1,00,000 h at temp level D	upto 1,15,000 h at temp level D	upto 1,00,000 h at temp level D	upto 1,15,000 h at temp level D
11	Switching operation	Max 5000 per year	Max 6000 per year	Max 5000 per year	Max 6000 per year
12	Capacitance tolerance	-5/+10%			
13	Voltage test				
	- Between terminals	2.15*UN, AC, 2s as per IS & IEC			
	- Between earth & terminals	3.6 KV, AC, 2s as per IS & IEC			
14	Discharge resistors	Fitted: standard discharge time 180 seconds as per IS13340 (Part 1):2012			
15	Safety	Self healing + pressure sensitive disconnector + discharge device			
16	Protection	IP20			
17	Casing	Aluminium Can		Metal Box	
18	Dielectric	Metallized Polypropylene film			
19	Impregnation	NCPB			
		Soft polyurethene Resin			
20	Ambient temperature	-25 °C / + 55 °C (Class D)			
21	Humidity	95%			
22	Altitude	4000 m above sea level			
23	Mounting	Indoor, vertical position			
24	Connection	M-5 Screw	M-5 Screw on double three way connection	Threaded Bolt with Insulator	
25	Fixing and earthing	Up to 4 kvar: Threaded M8 stud at bottom	Up to 2.1 kvar: Threaded M8 stud at bottom	1-4 kvar: Stand alone construction with wall Mounting bracket	Stand alone construction with fixing bracket at bottom
		Above 4 kvar: Threaded M12 stud at bottom	Above 2.1 kvar: Threaded M12 stud at bottom	Above 4 kvar: Stand alone construction with fixing bracket at bottom	

Alpican™

Gas filled Heavy duty capacitors

Technical specifications

Sr. No	Specifications	
1	Standards:	IS 13340-1993, IS 13341-1992,
		IEC 60831-1/-2, IEC- 60831-1&2
2	Rated voltage	440 V
3	Frequency	50/60 Hz
4	Power range	5 to 25 KVAr
5	Losses (Dielectrical)	< 0.20 W/KVAr
6	Losses (Total)	< 0.5 W/KVAr
7	Peak inrush current	300*In
8	Over voltage	UN+10% for 8 Hrs in 24 Hrs
9	Over current	1.4 * In
10	Mean life expectancy	upto 1,80,000 h at temp level C
11	Switching operations	Maximum 7000 per year
12	Capacitance tolerance	-5/10%
13	Voltage test between terminals	1.75*Un, AC, 2S as per IS
14	Voltage test between earth & terminals	3.6 KV, AC, 2S as per IS
15	Discharge resistors: Fitted:	standard discharge time less than at residual voltage of 50 V, 60 second as per IS
16	Safety	Self healing + pressure sensitive disconnector + discharge device
17	Protection	IP20
18	Casing	Aluminium Can
19	Dielectric	Metallized Polypropylene film
20	Impregnation	Inert gas impregnated
21	Ambient temperature	-40 ^{0}C / + 55 ^{0}C (Class D)
22	Humidity	95%
23	Altitude	4000 m above sea level
24	Mounting	Indoor, vertical position
25	Fixing and earthing	Threaded M12 stud at bottom

Reactors

Technical specifications

Sr. No	Specifications	
1	Standard	IEC 60076-6
2	Rated line voltage	440 V
3	Rated frequency	50 Hz
4	Tuning order	3.78 / 2.7
5	Tolerance on inductance	0 to 6%
6	Dielectric test	50 Hz 3 KV, 60 S
7	Protection class	IP00
8	Cooling method	Natural Air
9	Ambient temperature	+40 °C
10	Insulation class	H
11	Insulation level	1.1 KV
12	Blocking factor p%	7% / 14%
13	Temperature Protection (NC)	Yes

Technical specifications

Sr.No.	Specifications	
1	Steps	4, 6, 8 and 12 controlled steps
2	Operation	- 10 to + 50 °C
3	Storage	- 20 to + 80 °C
4	Rated current	5 A
5	Operating limit	0.125 A to 5.5 A
6	Sensitive to the CT polarity	No
7	Sensitive to the phase rotation polarity	No
8	Frequency	50 Hz/60 Hz
9	Power factor	0.85 inductive to 0.95 capacitive
10	Same step reconnection time	1 to 600 s
11	Mode	Manual & Automatic
12	Internal temperature sensor	Yes
13	Volt-free contact for remote alarm	Yes
14	Alarm display (overvoltage, over/under compensation, overload, etc.)	Yes

CTX³ capacitor switching units Cat.Nos 4168 74/75/76/77

Capacitor unit is connected to the terminals of the contactor to reduce the high inrush current.
IEC 60947-4-1 AC 6b

Type	Contactor		Maximum operating power (kvar)			Max. Peak current (A)
			220 - 240 V	400 - 440 V	500 - 550 V	
4 168 74	CTX³ 22	9 A	5	9.7	14	560
	CTX³ 22	12 A	6.7	12.5	18	560
	CTX³ 22	18 A	8.5	16.7	24	850
	CTX³ 22	22 A	10	18	26	1250
	CTX³ 40	32 A	15	25	36	1900
	CTX³ 40	40 A	20	33.3	48	2160
4 168 75/76	CTX³ 65	50 A	20	40	58	2160
	CTX³ 65	65 A	25	45.7	66	3040
4 168 76/77	CTX³ 100	75 A	29.7	54	78	3040
	CTX³ 100	85 A	35	60	92	3040
	CTX³ 100	100 A	37	62	94	3040

Note: - When the switch is closed capacitor must be discharged before recharged. (Maximum residual voltage at terminals ≤ 50 V)
- To prevent short current, gG type fuse must be 1.5 - 2 times than rated current

Features of capacitor unit (Pre-loading resistor)

- Damping resister that can limit the inrush current up to 60 x In by closing earlier than the main contacts of the contactor
- No heat loss by the serial resistor
- Eliminates the switching surge
- Improves the performance of the capacitor system

Operation sequence

Capacitor unit: OFF
Contactor: OFF

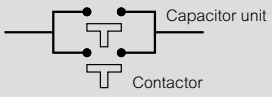


Fig.1

Capacitor unit: ON
Contactor: OFF

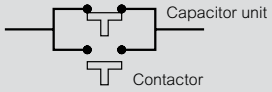


Fig.2

Capacitor unit: OFF
Contactor: ON

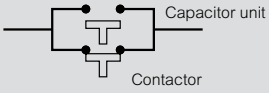
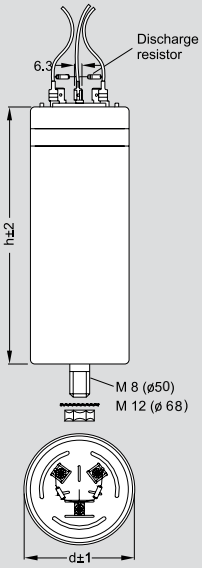


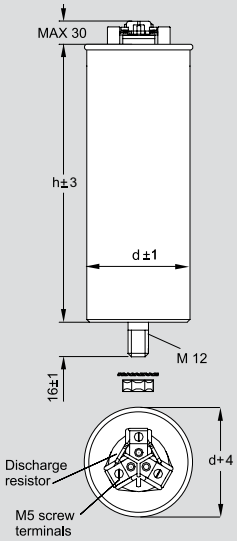
Fig.3

Note - Closing sequence: Fig.1 => Fig.2 => Fig.3
Opening sequence: Fig.3 => Fig.1

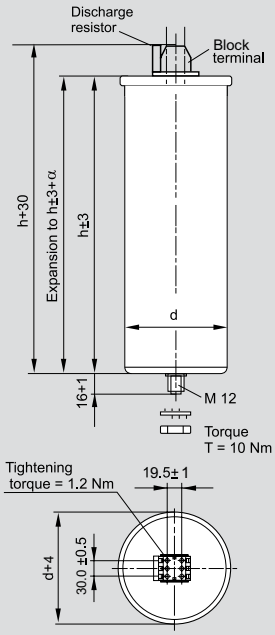
Dimension



SD CYL 440 V: 1-5 kVAr
HD CYL 440 V: 1-4 kVAr



SD CYL 440 V: 7.5-30 kVAr
SD CYL 480 V: 4.2-20.8 kVAr
SD CYL 525 V: 5-25 kVAr



HD CYL 440 V: 5-30 kVAr

SD CYL 440 V

Cat.Nos	Rating kVAr	Capacitor dia (mm)	Capacitor height (mm)	Packaging qty in Primary carton	Packaging qty in Master carton
5150 00	1	50	150	1	12
5150 01	2	50	150	1	12
5150 02	3	50	150	1	12
5150 03	4	50	150	1	12
5150 04	5	68	195	1	12
5150 05	7.5	75	210	1	6
5150 06	10	85	210	1	4
5150 07	12.5	85	285	1	4
5150 08	15	85	285	1	4
5150 09	20	85	360	1	4
5150 10	25	90	360	1	4
5150 11	30	90	360	1	4

SD CYL 480 V

Cat.Nos	Rating kVAr	Capacitor dia (mm)	Capacitor height (mm)	Packaging qty in Primary carton	Packaging qty in Master carton
5150 24	4.2	75	210	1	6
5150 25	6.9	85	285	1	4
5150 26	8.7	85	285	1	4
5150 27	10.4	85	285	1	4
5150 28	14	85	360	1	4
5150 29	17.4	90	360	1	4
5150 30	20.8	90	360	1	4

SD CYL 525 V

Cat.Nos	Rating kVAr	Capacitor dia (mm)	Capacitor height (mm)	Packaging qty in Primary carton	Packaging qty in Master carton
5150 31	5	75	210	1	6
5150 32	8.3	85	285	1	4
5150 33	10.4	85	285	1	4
5150 34	12.5	85	285	1	4
5150 35	16.7	85	360	1	4
5150 36	20.8	90	360	1	4
5150 37	25	90	360	1	4

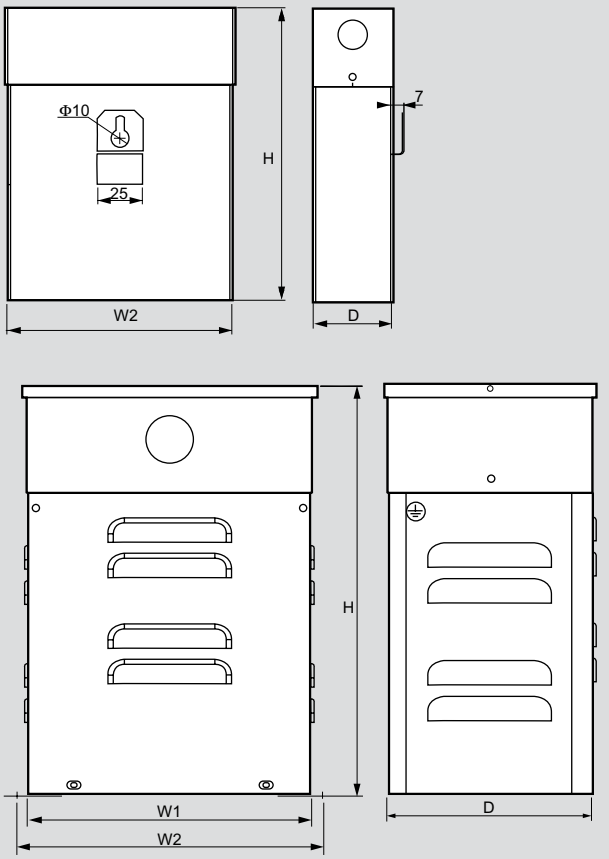
HD CYL 440 V

Cat.Nos	Rating kVAr	Capacitor dia (mm)	Capacitor height (mm)	Packaging qty in Primary carton	Packaging qty in Master carton
5150 12	1	50	150	1	12
5150 13	2	50	150	1	12
5150 14	3	68	195	1	12
5150 15	4	68	195	1	12
5150 16	5	75	210	1	6
5150 17	7.5	85	285	1	4
5150 18	10	90	285	1	4
5150 19	12.5	85	360	1	4
5150 20	15	90	360	1	4
5150 21	20	100	360	1	2
5150 22	25	116	360	1	2
5150 23	30	136	295	1	2

Alpx³

box type capacitors

Dimension



SD BOX 440V: 1-50 kVAr

Cat.Nos	Rating kVAr	Cap Width (W1 ±5) (mm)	Cap Width (W2 ±5) (mm)	Cap Depth (D ±5) (mm)	Cap Height (H ±5) (mm)	Packaging qty in Primary carton	Packaging qty in Master carton
5150 40	1	--	125	45	170	1	4
5150 41	2	--	125	45	170	1	4
5150 42	3	--	155	55	215	1	4
5150 43	4	--	155	55	215	1	4
5150 44	5	155	185	55	230	1	1
5150 45	7.5	155	185	55	230	1	1
5150 46	8.3	155	185	55	230	1	1
5150 47	10	225	245	80	350	1	1
5150 48	12.5	225	245	80	350	1	1
5150 49	15	225	245	80	350	1	1
5150 50	20	225	250	160	300	1	1
5150 51	25	225	250	160	300	1	1
5150 52	50	225	250	320	300	1	1

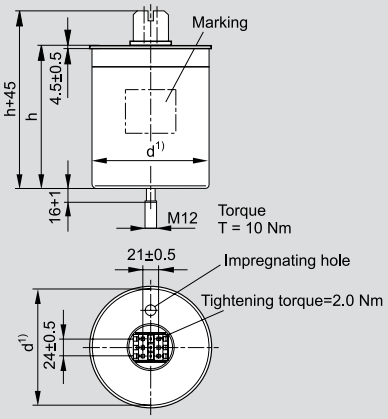
HD BOX 440V: 5-50 kVAr

Cat.Nos	Rating kVAr	Cap Width (W1 ±5) (mm)	Cap Width (W2 ±5) (mm)	Cap Depth (D ±5) (mm)	Cap Height (H ±5) (mm)	Packaging qty in Primary carton	Packaging qty in Master carton
5150 53	5	225	245	80	350	1	1
5150 54	7.5	225	245	80	350	1	1
5150 55	8.33	225	245	80	375	1	1
5150 56	10	225	250	80	375	1	1
5150 57	12.5	225	250	80	375	1	1
5150 58	15	225	250	160	425	1	1
5150 59	20	225	250	160	425	1	1
5150 60	25	225	250	160	425	1	1
5150 61	50	225	250	320	425	1	1

Alpican™

gas filled capacitors

Dimension



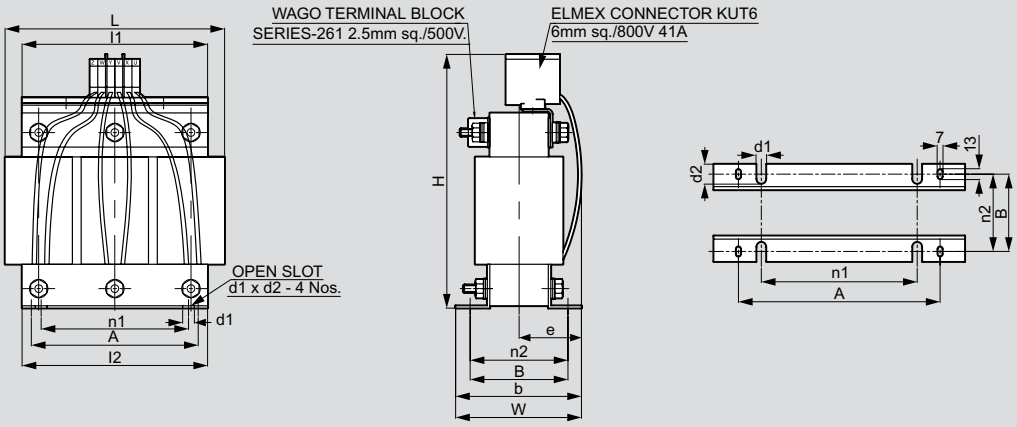
Creepage distance 12.7 mm min.
Clearance 9.6 mm min.

440 V Gas filled heavy duty

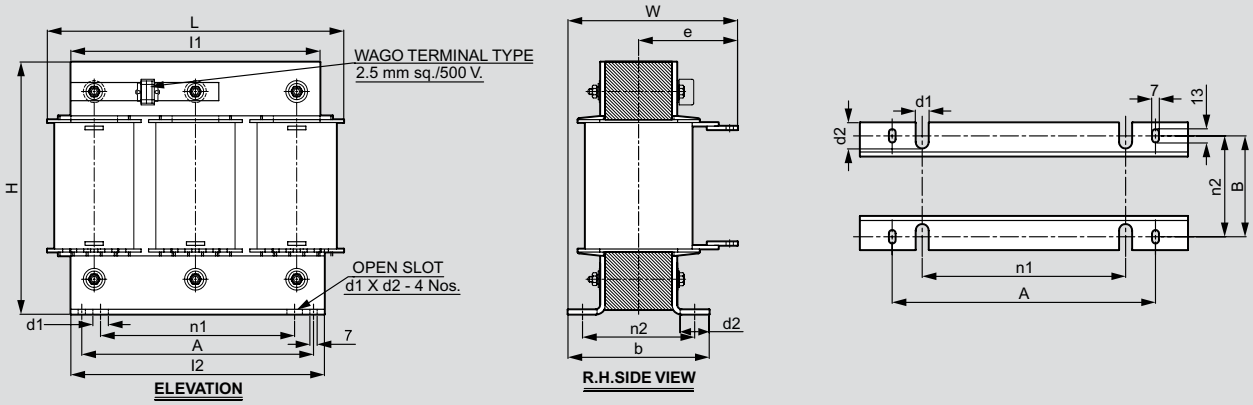
Cat.Nos	Dimensions	
	Diameter	Height
4151 24	116	164
4151 25	116	164
4151 26	116	164
4151 27	116	164
4151 28	116	164
4151 29	116	200
4151 30	136	200
4151 31	136	200

Reactor

Dimension



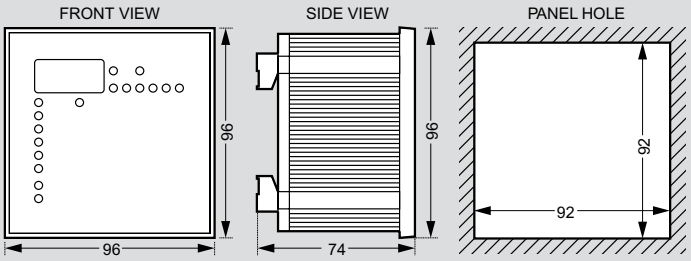
Cat.Nos	KVAR	Rated Current	L	W	H	I1	I2	n1	n2	b	e	d1	d2	A	B
4151 48	10	13.2A.	190	140±5mm	210	165	165	60	78±3mm	100	90±5mm	10.8	15.5	85	78
4151 49	12.5	16.4A.	190	140±5mm	210	165	165	60	78±3mm	100	90±5mm	10.8	15.5	85	78



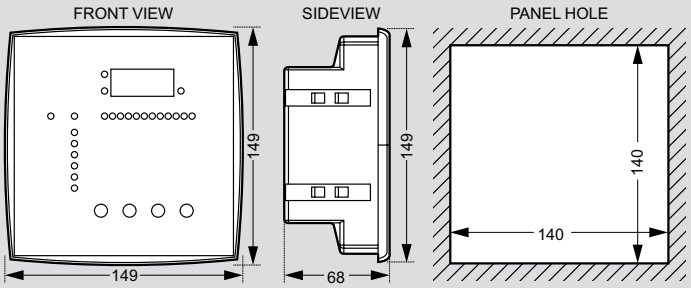
Cat.Nos	KVAR	Rated Current	L	W	H	I1	I2	n1	n2	b	e	d1	d2	A	B
4151 50	25	32.8A.	240	175±5mm	205	205	205	150	98±3mm	112	115±5mm	10.8	15.5	175	95
4151 51	50	65.61.A.	275	230±5mm	240	235	235	150	168±3mm	185	135±5mm	10.8	15.5	175	165
4151 52	100	131.22.A	330	180±5mm	270	285	285	150	132±3mm	155	98±5mm	10.8	15.5	175	132

Dimension

96 x 96 - Models



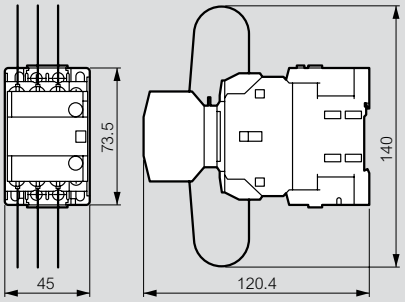
144 x 144 - Models



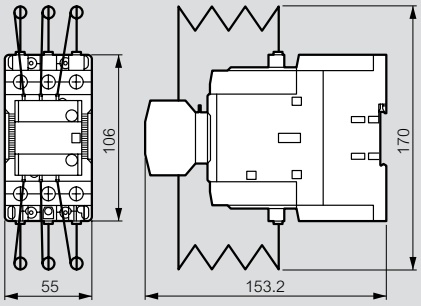
Dimension

Overall dimensions of contactors equipped with CTX³ switching units

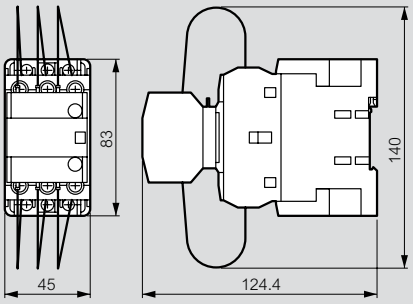
Cat.No 4 168 74 on CTX³ 22



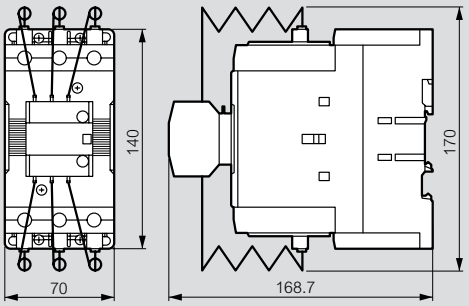
Cat.No 4 168 75/76 on CTX³ 65

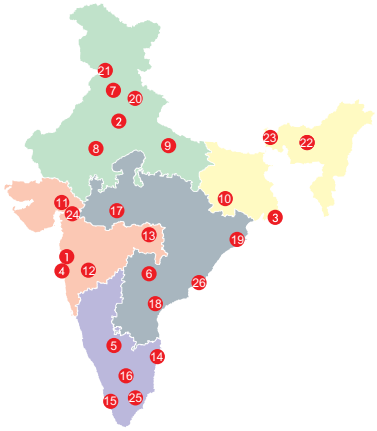


Cat.No 4 168 74 on CTX³ 40



Cat.No 4 168 76/77 on CTX³ 100





Head office

1. 61 & 62, 6th Floor,
Kalpataru Square, Kondivita Road,
Off Andheri-Kurla Road, Andheri (E),
MUMBAI – 400 059.
Tel : (022) 3041 6200
Fax : (022) 3041 6201
Website : www.legrand.co.in

Regional sales offices

2. A-25, Mohan Co-operative
Industrial Estate, Mathura Road,
NEW DELHI - 110 044.
Tel : (011) 3990 2200, 2699 0046,
(011) 2699 0028 / 29 / 30 / 31
Fax : (011) 2699 0047

3. Bhakta Towers, 2nd & 3rd Floor,
Plot No. KB 22, Sector-III, Saltlake,
KOLKATA – 700 098.
Tel : (033) 4021 3535 / 36
Fax : (033) 4021 3537

4. C/203, Corporate Avenue, Atul Projects,
Near Mirador Hotel, Chakala,
Andheri Ghatkopar Link Road,
Andheri – East, **MUMBAI** – 400 099.
Tel : (022) 3385 6200 / 62301000 INOVAL

5. Ferozes Manor,
Situated at 58 Hospital Road,
Shivaji Nagar,
BANGALORE – 560 001.
Tel : (080) 6822 0000 INOVAL

6. 205-208, 2nd Floor,
Block - II, White House,
Kundan Bagh, Begumpet,
HYDERABAD – 500 016.
Tel : (040) 2341 4398 / 67, 4567 1717
Fax : (040) 4567 1730

Branch offices

7. SCO 1-2-3, Second Floor, Sector 17B,
CHANDIGARH – 160 017.
Tel : (0172) 305 8631 / 32 / 33 / 34 / 35
Fax : (0172) 501 9008

8. 507-510, Vth Floor, Soni Paris Point,
Jai Singh Highway, Banipark,
JAIPUR – 302 016.
Telefax : (0141) 511 3129, 510 1179

9. 209-A, 2nd Floor, Cyber Heights,
Opp. Indira Gandhi Pratishthan,
Vibhuti Khand, Gomti Nagar
LUCKNOW - 226 010.
Tel : (522) 319 2031 / 32 / 33 INOVAL

10. 202 & 203, 2nd Floor, Sunrise,
Forum 100, Burdwan Compound, Lalpur,
RANCHI - 834 001.
Tel : (651) 660 5400

11. A 101-102, Mondeal Heights,
Besides Novotel Hotel, Sarkhej
Gandhinagar Highway (S G Highway),
AHMEDABAD – 380 015.
Tel : (079) 6134 0555 INOVAL

12. 402, Swastik Chambers,
Near Ashwamegh Marriage Hall,
Behind HP Petrol Pump,
Off Karve Road, Erandwane,
PUNE – 411 004.
Tel : (020) 6729 5601 / 602
Fax : (020) 6729 5604

13. Plot No.95, II Floor, Shreyash Heights,
VIP Road, Ramdaspeth,
NAGPUR – 440 010.
Tel : (0712) 662 7857 / 858
Fax : (0712) 662 7859

14. 10 B, (10th Floor), Prestige Center Court
Office Block Vijaya Forum Mall, #183,
N.S.K. Salai, Vadapalani
CHENNAI – 600 026.
Tel : (044) 6612 2800 / 2362 3125 / 35 / 45
Fax : (044) 2362 3165

15. J. B. Manjooran Estate, Door No 50/1107A9,
3rd Floor, Bye Pass Junction, Edappally,
COCHIN – 682 024.
Tel : (0484) 280 1921 / 2921, 658 0921
Fax : (0484) 280 1921 / 2921

16. B-5, 1st Floor, Thirumalai Towers,
723, Avanashi Road,
COIMBATORE – 641 018.
Tel : (0422) 222 3634 / 0283
Fax : (0422) 222 3164

17. 204-205, Megapolis Square,
579, M G Road,
INDORE – 452 001.
Tel : (0731) 4999 891 / 892

18. MF-2, Datta's Lords House,
Jammi Chettu Street, Mogalrajapuram,
VIJAYAWADA – 520 010.
Tel : (0866) 661 1393, 664 6393
Fax : (0866) 669 9393

19. Plot No. 359,
Saheed Nagar, 2nd Floor,
BHUBANESWAR – 751 007.
Tel : (0674) 254 0623

Area offices

20. Unit - 1 & 2 , Vijay Park,
Main Chakrata Road,
DEHRADUN - 248 001.
Uttarakhand.
Tel : (0135) 661 6100 INOVAL

21. Cabin No. 9,
Second Floor,
Madhok Trade Centre,
Madhok Complex,
Ferozpur Road,
LUDHIANA – 141 001.
Tel : (0161) 277 0301 / 2 / 3 / 4

22. House No. 97, Ground Floor,
Rajgarh Main Road,
Opp. City Heart Nursing Home,
GUWAHATI – 781 007.
Tel : (0361) 245 8498

23. 94, Udham Singh Sarani,
Ground Floor, Ashrampara,
SILIGURI – 734 001.
Tel : (0353) 264 1067

24. 405, City Centre, Sosyo Circle,
Udhana Magdalla Road,
SURAT - 395 002.
Tel : (0261) 263 3861

25. Aparna Towers, 1st Floor,
2/3, Bypass Road,
MADURAI – 625 010.
Telefax : (0452) 230 8414

26. 404, Eshwar Plaza,
Dwaraka Nagar, Main Road,
Beside Bata Show Room,
VISHAKHAPATNAM – 530 016.
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Technical assistance from Legrand

Telephonic technical assistance for selection of products, technical information, guidance, wiring diagrams and estimation is now made available to you at each Regional Office. Contact the Technical Officer of Legrand at the following telephone numbers

New Delhi : Tel.: (011) 2699 0028, 3990 2200
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