Alpivar² & Alpican™

REACTIVE ENERGY COMPENSATION

CAPACITOR **CATALOGUE**

THE GLOBAL SPECIALIST
IN ELECTRICAL AND DIGITAL BUILDING INFRASTRUCTURES

legrand®

The Legrand Edge

The Legrand group is a global specialist in electrical & digital building infrastructure with a comprehensive range of solutions in four fields : energy distribution, voice data and image distribution , cable management and control & monitoring of installations that cater to the residential, commercial, hospitality and industrial segments.

Legrand (India) has been a leader in the protection business for the last four decades. Legrand combines the latest technology with aesthetics and flexibility to design electrical power distribution systems to guarantee efficient protection and effective service quality.

Today, the ever rising demand of electrical power and therefore the need for identifying ways and means of conserving this energy are the two topics that get debated the most. The effective utilization of the available power and power losses are increasingly becomingly a concern for users as well as utilities. Strengthening the brand philosophy of "Listen, Design, Make, Support" further and responding to these requirements of the market, Legrand now offers a range of capacitors with detuned reactors & automatic power factor controllers as a part of reactive energy compensation.

Contribute to energy saving and reduce environmental impact

The available power in an electrical supply system comprises of active power and reactive power. While active power results in the form of actual work, the reactive power is used to maintain the magnetic field. The power factor is an indicator of reactive power which is always an inherent part of the electrical system.
Lower the power factor higher is the reactive power usage. Hence, the challenge is to improve the power factor and the most cost effective way to improve it is by the use of power capacitors.
Improved power factor helps in reducing I^2R losses, improves voltage stability and increase utilization of an electrical distribution system. As a result, it further helps customer to save energy and reduce their environmental impact.

With Legrand's range of solutions for reactive energy compensation that include capacitors, detuned reactors, automatic power factor controller and capacitor banks, you will have the power to contribute to energy savings. Be it commercial, or industrial segment, Legrand capacitors increase the service life of installation while improving its power factor.

By installing Legrand Capacitors, now you can

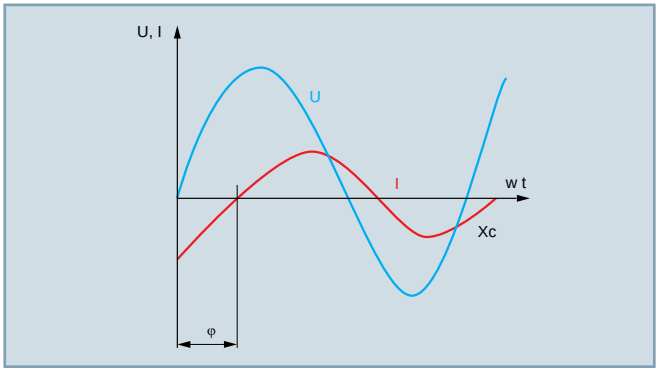
- Improve power quality
- Reduce the active energy losses
- Improve the voltage regulation
- Improve utilization of electrical system
- Eliminate penalties
- In turn, save money, by not paying for the reactive energy that you otherwise would have consumed

Power factor

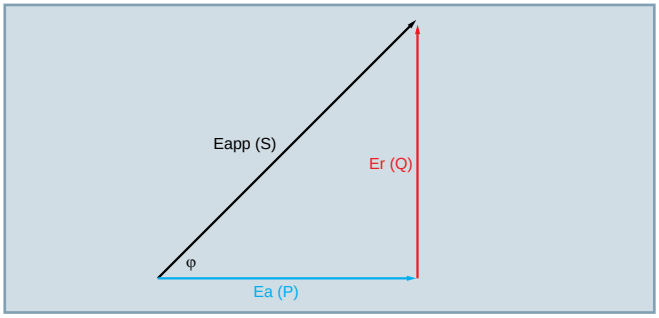
PHASE SHIFT - ENERGIES - POWERS

Definition

An AC electrical installation comprising receivers such as transformers, motors, welding machines, power electronics, etc., and in particular any receivers for which the current is out of phase with the voltage, consumes a total energy which is called the apparent energy (Eapp).



This energy, which is generally expressed in kilovolt-ampere-hours (kVAh), corresponds to the apparent power S (kVA) and can be broken down as follows:



• Active energy (Ea): expressed in kilowatt hours (kWh). This can be used, after being transformed by the receiver, in the form of work or heat. The active power P (kW) corresponds to this energy.

• Reactive energy (Er): expressed in kilovar hours (kVArh). This is used in particular in the windings of motors and transformers to create the magnetic field without which they would not be able to operate.
The reactive power Q (kVAr) corresponds to this energy. Unlike active energy, reactive energy is said to be "unproductive" for the user.

Energies

$$\vec{Eapp} = \vec{Ea} + \vec{Er}$$

$$Eapp = \sqrt{(Ea)^2 + (Er)^2}$$

Powers

$$\vec{S} = \vec{P} + \vec{Q}$$

$$S = \sqrt{(P)^2 + (Q)^2}$$

• Three-phase supply:

$$S = \sqrt{3}\,UI$$

$$P = \sqrt{3}\,UI\,\cos\varphi$$

$$Q = \sqrt{3}\,UI\,\sin\varphi$$

For a single phase supply the term $\sqrt{3}$ disappears.

• U : Voltage (V)
• I : Current (I)
• φ : Phase angle between current & voltage

POWER FACTOR

By definition, the power factor, or the Cos φ, of an electrical device is equal to the active power P (kW) over the apparent power S (kVA), and can vary from 0 to 1.

$$\cos \varphi = \frac{P\ (kW)}{S\ (kVA)}$$

It thus enables the reactive energy consumption level of devices to be easily identified.

- A power factor of 1 will result in no reactive energy consumption (resistance)

- A power factor of less than 1 will lead to reactive energy consumption which increases the closer it is to 0 (inductance)

In an electrical installation, the power factor could vary from one workshop to another depending on the equipment installed and the way it is used (off-load, full load operation, etc.).

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

Calculation of the tg φ

$$\text{tg } \varphi = \frac{Er\ (kVArh)}{Ea\ (kWh)}$$

The tg φ is the ratio between the reactive energy Er (kVArh) and the active energy Ea (kWh) consumed during the same period.

Unlike the cos φ, it is easy to see that the tg φ must be as small as possible in order to have the minimum reactive energy consumption.

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

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

But it is simpler to refer to a conversion table as on page 16.

Power factor (continued)

POWER FACTOR OF THE MAIN RECEIVERS

The following receivers consume the most reactive energy:

- Motors at low load
- Welding machines
- Arc and induction furnaces
- Power rectifiers

RECEIVER		COS φ	TG φ
Ordinary asynchronous motors loaded at	0%	0.17	5.80
	25%	0.55	1.52
	50%	0.73	0.94
	75%	0.80	0.75
	100%	0.85	0.62
Incandescent lamps		approx. 1	approx. 0
Fluorescent lamps		approx. 0.5	approx. 1.73
Discharge lamps		0.4 to 0.6	approx. 2.29 to 1.33
Resistance furnaces		approx. 1	approx. 0
Compensated induction furnaces		approx. 0.85	approx. 0.62
Dielectric heating furnaces		approx. 0.85	approx. 0.62
Resistance welding machines		0.8 to 0.9	0.75 to 0.48
Single phase static arc welding stations		approx. 0.5	approx. 1.73
Arc welding transformers/rectifiers		0.7 to 0.9	1.02 to 0.48
		0.7 to 0.8	1.02 to 0.75
Arc furnaces		0.8	0.75
Thyristor power rectifiers		0.4 to 0.8	2.25 to 0.75

ADVANTAGES OF A GOOD POWER FACTOR

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

A good power factor makes it possible to optimise an electrical installation and provides the following advantages:
- No billing of reactive energy
- Reduction of the subscribed demand in kVA
- Limitation of active energy losses in the cables given the decrease in the current carried in the installation
- Improvement of the voltage level at the end of the line
- Additional power available at the power transformers if the compensation is performed at the secondary

HOW TO IMPROVE THE POWER FACTOR

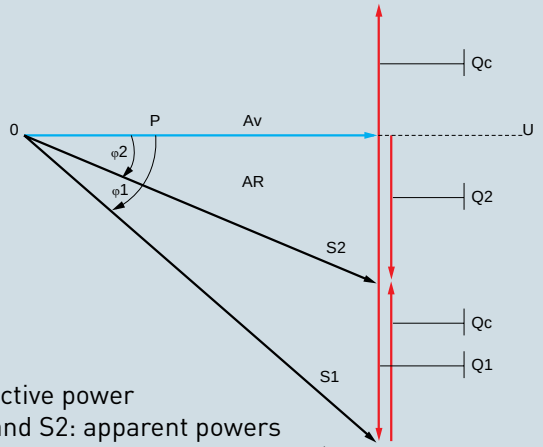
By installing capacitors or capacitor banks.

Improving the power factor of an electrical installation consists of giving it the means to "produce" a certain proportion of the reactive energy it consumes itself.

There are various different systems for producing reactive energy, including in particular asynchronous compensators and shunt capacitors (or serial capacitors for large transmission systems).

The capacitor is most frequently used, given it's :
- Non-consumption of active energy
- Purchase cost
- Ease of use
- Service life
- Low maintenance (static device)

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

The capacitor is a receiver composed of two conductive parts (electrodes) separated by an insulator.
When this receiver is subjected to a sinusoidal voltage, the current and therefore its power (capacitive reactive) is leading the voltage by 90°.

Conversely, for all other receivers (motors, transformers etc.) the current and therefore its power (reactive inductive) is lagging the voltage by 90°.

The vectorial composition of these currents or reactive powers (inductive and capacitive) gives a resulting 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.

Operation, protection and connection of capacitors

PROTECTION AND CONNECTION OF CAPACITORS

Operating device

In the case of loads with ultra-fast cycles (welding machines, etc.), the conventional system for operating capacitors (electromechanical contactors) is no longer suitable. High-speed switching compensation systems using solid state contactors are necessary.

The switching current of a capacitor depends on:
- The power of the capacitor
- The short-circuit power of the mains supply to which it is connected
- Whether or not any capacitor banks that have already been activated are present

Given these parameters, it is essential to use quick make and break operating devices (switch, contactor etc.).
When selecting operating devices, the user must be made aware of the choice of equipment available (for operating capacitors).
Contactors are specially designed by contactor manufacturers for operating capacitors and in particular for assembling automatically controlled capacitor banks. These contactors have auxiliary poles combined in series with preload resistors that will limit the inrush current during activation.

Protection

In addition to the internal protection devices incorporated in the capacitor:
- Self-healing metallised film
- Internal fuses
- Overpressure disconnection devices

it is essential to provide a protection device external to the capacitor.

This protection will be provided by:

- Either a circuit breaker:
  - Thermal relay, setting between 1.3 and 1.5 In
  - Magnetic relay, setting between 5 and 10 In
- Or GI type HRC fuses, rating 1.4 to 2 In

In = capacitor nominal current
$In = Qc/\sqrt{3}U$
Example: 50 kVAr - 400 V three-phase
In = 50/1.732 x 0.4 = 72 A

Connection (sizing the cables)

Current standards for capacitors are defined so that capacitors can withstand a permanent overcurrent of 30%.
These standards also permit a maximum tolerance of 10% on the nominal capacitance.
Cables must therefore be sized at least for:
I cable = 1.3 x 1.1 (I nominal capacitor)

i.e. Icable = 1.43 In

Harmonics

INTRODUCTION

In recent years, the modernisation of industrial processes and the sophistication of electrical machines and equipment have led to major developments in power electronics:

Semi-conductor-based systems (transistors, thyristors etc.) designed for:
- Static power converters: AC/DC
- Rectifiers
- Inverters
- Frequency converters
- And many other multicycle or phase controlled devices.

These systems represent "non-linear" loads for electrical supplies. A "non-linear" load is a load for which the current consumption does not reflect the supply voltage (although the voltage of the source imposed on the load is sinusoidal, the current consumption is not sinusoidal).

Other "non-linear" loads are also present in electrical installations, in particular:
- Variable impedance loads, using electric arcs: arc furnaces, welding units, fluorescent tubes, discharge lamps etc.
- Loads using strong magnetising currents: saturated transformers, inductors etc.

The FOURIER decomposition (harmonic analysis) of the current consumption of a non-linear receiver shows:
- The fundamental, a sinusoidal term at the 50 Hz mains supply frequency
- The harmonics, sinusoidal terms whose frequencies are multiples of the fundamental frequency

According to the equation:

$$I_{rms} = \sqrt{I_1^2 + \sum_{h=2}^{n} I_h^2}$$

$\sum$: Sum of all the harmonic currents from harmonic 2 (50 Hz x 2) to the last harmonic n (50 Hz x n)

These harmonic currents circulate in the source. The harmonic impedances of the source then give rise to harmonic voltages, according to the equation:

$$Uh = Zh \times Ih$$

The harmonic currents give rise to most of the harmonic voltages causing the overall harmonic distortion of the supply voltage.

$$V_{rms} = \sqrt{U_1^2 + \sum_{h=2}^{n} U_h^2}$$

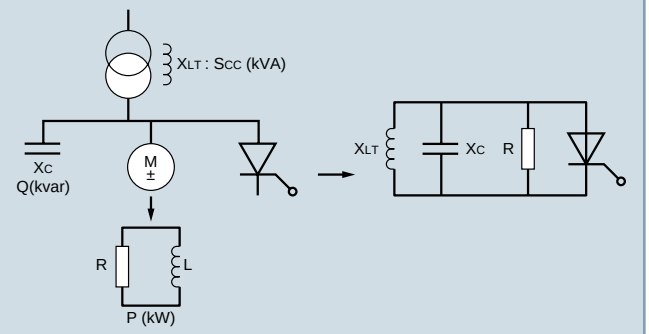
Note: The harmonic distortion of the voltage generated by construction defects in the windings of the alternators and transformers is generally negligible

- Uh : Harmonic voltage
- Ih : Harmonic current
- Zh : Harmonic impedances

Harmonics (continued)

EFFECT OF HARMONICS ON CAPACITORS

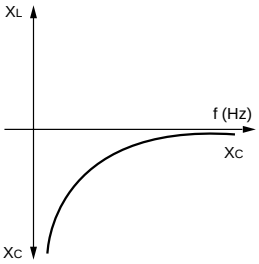
Schematic diagram **Equivalent diagram**



Note: As the inductance of the motor is much higher than that of the source, it becomes negligible in parallel configuration.

- Ssc (kVA) : Source short-circuit power
- Q (kVAr) : Capacitor bank power
- P (kW) : Non-interfering load power
- XLT : Transformer reactance
- XC : Capacitor reactance

Reduction of the reactance of the capacitors



- The capacitor reactance

$$Xc = \frac{1}{C.\omega} = \frac{1}{C.2.\pi.f}$$

is inversely proportional to the frequency, its ability to cancel out harmonic currents decreases significantly when the frequency increases.

- C : Capacitor
- XL : Inductive reactance

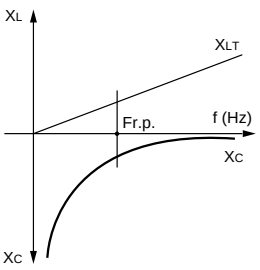
- The higher the source short-circuit power (Ssc), the further the resonance frequency is from dangerous harmonic frequencies.
- The higher the power (P) of the non-polluting loads, the lower the harmonic current amplification factor.

Main harmonic currents

The main harmonic currents present in electrical installations come from semi-conductor based systems. The theoretical rates of such systems are as follows:
- Harmonic 5 (250 Hz) - I5 - 20% I1*
- Harmonic 7 (350 Hz) - I7 - 14% I1*
- Harmonic 11 (550 Hz) - I11 - 9% I1*
- Harmonic 13 (650 Hz) - I13 - 8% I1 *

(* I1: Semi-conductor system current at 50 Hz)

Parallel resonance or anti-resonance between capacitors and source



- The reactance of the source X_{LT} is proportional to the frequency
- The reactance of the capacitors Xc is inversely proportional to the frequency

At frequency Fr.p., there is parallel resonance or anti-resonance (as the two reactances are equal but opposite) and amplification (F.A.) of the harmonic currents in the capacitors and in the source (transformers) where:

$$Fr.p. = F\ supply \sqrt{\frac{Ssc}{Q}} \qquad F.A. = \sqrt{\frac{Ssc.\ Q}{P}}$$

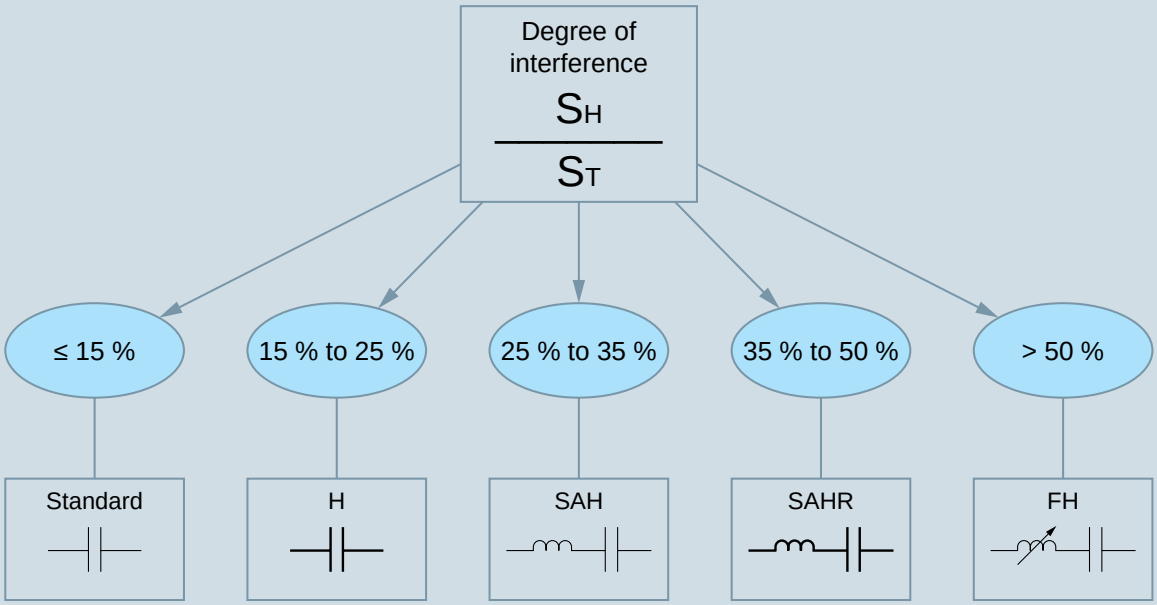
PROTECTING CAPACITORS FROM HARMONICS

By design and in accordance with current standards, capacitors are capable of continuously withstanding an rms current equal to **1.3 times the nominal current** defined at the nominal voltage and frequency values.

This overcurrent coefficient has been determined to take account of the combined effects of the presence of harmonics and overvoltages (the capacitance variation parameter being negligible).

It can be seen that depending on the degree of harmonic pollution SH (power of the harmonic generators), this coefficient is generally insufficient and that the parameter Ssc (short-circuit power), directly related to the power of the source ST, is preponderant in the value of the parallel resonance frequency (Fr.p).

By combining these two parameters, SH and ST, three types of mains supply can be defined, with a corresponding "type" of capacitor to be installed:



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.
Standard - Standred duty capacitor.
H - Heavy duty capacitor.
SAH - Heavy duty capacitor with series recactor.
SAHR - Heavy duty capacitor with series recactor with resonance.
FH - Heavy duty capacitor with detuned recactor.

Harmonics (continued)

PROTECTING CAPACITORS USING DETUNED REACTORS

For supplies with a high level of harmonic pollution, installing a detuned reactor, tuned in series with the capacitor, is the only effective protection.

The detuned reactor performs a dual role:
- Increasing the impedance of the capacitor in relation to the harmonic currents
- Shifting the parallel resonance frequency (Fr.p) of the source and the capacitor to below the main frequencies of the harmonic currents that are causing interference

- Fr.p.: Detuned reactor/capacitor/MV/LV transformer parallel resonance frequency

- Fr.s.: Detuned reactor/capacitor serial resonance frequency

- The most commonly used F.r.s values are:

- 50 Hz fundamental: 215 Hz (n=4.3)
  190 Hz (n=3.8)
  135 Hz (n=2.7)

- 60 Hz fundamental: 258 Hz (n=4.3)
  228 Hz (n=3.8)
  162 Hz (n=2.7)

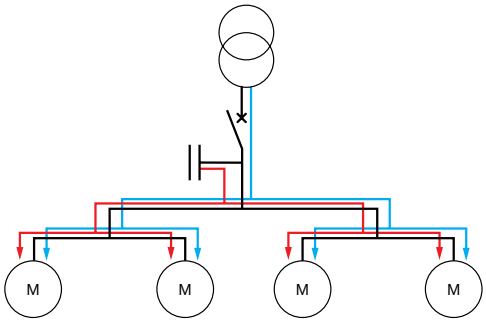
- For frequencies below Fr.s., the reactor/capacitor system behaves like a capacitance and compensates the reactive energy.
- For frequencies above Fr.s., the reactor/capacitor system behaves like an inductance which, in parallel with the inductance X_{LT}, prevents any risk of parallel resonance at frequencies above Fr.s. and in particular at the main harmonic frequencies.

Installing capacitor banks

INSTALLATION OPTIONS

In an LV electrical installation, capacitor banks can be installed at 3 different levels:

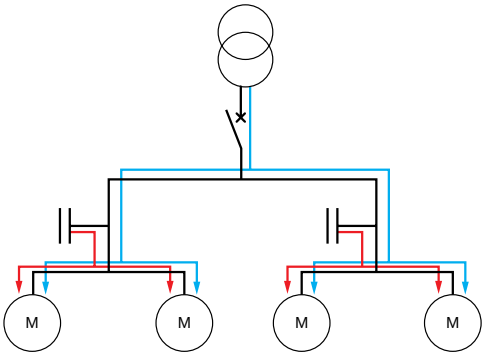
Global compensation



Advantages:
- No billing of reactive energy
- This is the most economical solution, as all the power is concentrated at one point and the expansion coefficient makes it possible to optimise the capacitor banks
- Makes less demands on the transformer

Note:
- The losses in the cables (I^2R) are not reduced.

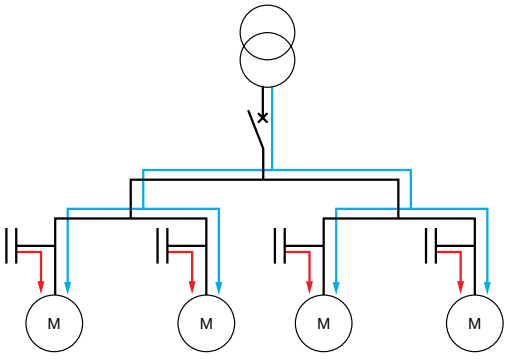
Sector compensation



Advantages:
- No billing of reactive energy
- Makes less demands on the supply FEEDERS and reduces the heat losses in these FEEDERS (I^2R)
- Incorporates the expansion of each sector
- Makes less demands on the transformer
- Remains economical

Note:
- Solution generally used for very widespread factory supplies

Individual compensation



Advantages:
- No billing of reactive energy
- From a technical point of view this is the ideal solution, as the reactive energy is produced at the point where it is consumed. Heat losses (I^2R) are therefore reduced in all the lines.
- Makes less demands on the transformer.

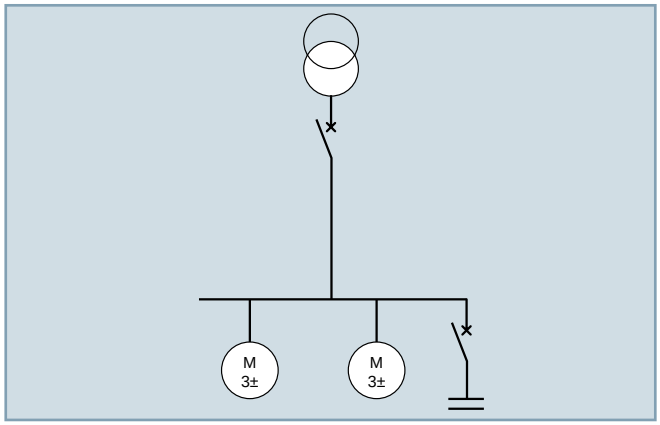
Note:
- Most costly solution, given:
- The high number of installations
- The fact that the expansion coefficient is not incorporated

Compensation systems

SYSTEMS AND TYPES OF COMPENSATION

When selecting a capacitor bank, there are two compensation systems.

Fixed type capacitor banks



• The reactive power supplied by the capacitor bank is constant irrespective of any variations in the power factor and the load thus the reactive energy consumption of the installation is also constant.

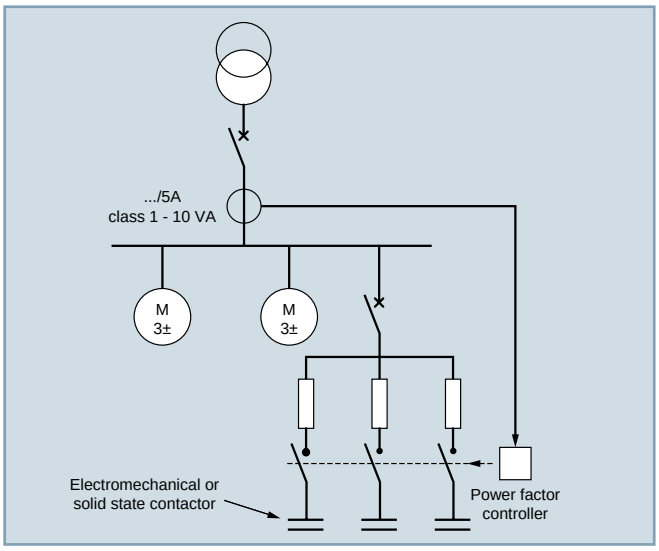
• These capacitor banks are switched on:
- Either manually by a circuit breaker or switch
- Or semi-automatically by a remote-controlled contactor

• This type of capacitor bank is generally used in the following situations:
- Electrical installations with constant load operating 24 hours a day
- Reactive compensation of transformers
- Individual compensation of motors
- Installation of a capacitor bank whose power is less than or equal to 15% of the power of the transformer

Capacitor bank Qc ≤ 15% P_{kVA} transformer

• P_{kVA} : Power of transformer
• Qc : Power of capacitor bank

Automatic type capacitor banks



• The reactive power supplied by the capacitor bank **can be adjusted** according to variations in the power factor and the load of the receivers, thus of the reactive energy consumption of the installation.

• These capacitor banks are made up of a combination of capacitor steps (step = capacitor + contactor) connected in parallel. Switching on and off of all or part of the capacitor bank is controlled by an integrated power factor controller.

• These capacitor banks are also used in the following situations:
- Variable load electrical installations
- Compensation of main LV distribution boards or major outgoing lines
- Installation of a capacitor bank whose power is more than 15% greater than the power of the transformer

Capacitor bank Qc > 15% P_{kVA} transformer

How to calculate the power of capacitors

BASED ON ELECTRICITY BILLS

Calculation

To calculate the capacitor banks to be installed, use the following method:
- Select the month in which the bill is highest (kVArh to be billed)
- Assess the number of hours the installation operates each month
- Calculate the capacitor power Qc to be installed

$$Qc = \frac{\text{kVArh to be billed (monthly)}}{\text{No. of hours' operation (monthly)}}$$

Example

For the subscriber:
- Highest reactive energy bill: December
- Number of kVArh to be billed: 70,000
- Monthly operating times:

high-load + peak times = 350 hours

$$Qc \text{ (bank to be installed)} = \frac{70{,}000}{350} = 200 \text{ kVAr}$$

How to calculate the power of capacitors (continued)

CAPACITOR POWER CALCULATION TABLE

Conversion table

Based on the power of a receiver in kW, this table can be used to calculate the power of the capacitors to change from an initial power factor to a required power factor. It also gives the equivalence between cos φ and tg φ.

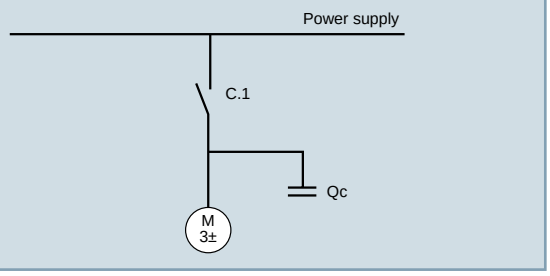
Final power factor		Capacitor power in kVAr to be installed per kW of load to increase the power factor to:										
cosφ		0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1
	tg φ	0.48	0.46	0.43	0.40	0.36	0.33	0.29	0.25	0.20	0.14	0.0
0.40	2.29	1.805	1.832	1.861	1.895	1.924	1.959	1.998	2.037	2.085	2.146	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

Examples: 200 kW motor - cos φ = 0.75, required cos φ = 0.93, Qc = 200 x 0.487 = 98 kVAr
200 kW motor - cos φ = 0.80, required cos φ = 0.95, Qc = 200 x 0.421 = 84 kVAr

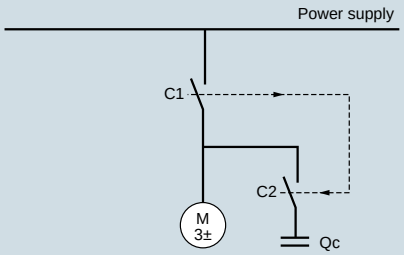
Reactive compensation of asynchronous motors

COMPENSATION AT MOTOR TERMINALS

If Qc ≤ 90% Io $\sqrt{3}$ U



If Qc > 90% Io $\sqrt{3}$ U



Io: motor off-load current
U: supply voltage

The table below gives, for information purposes only, the maximum power of the capacitor that can be connected **directly to the terminals of an asynchronous motor with no risk of self-excitation.** It will be necessary to check in all cases that the maximum current of the capacitor does not exceed 90% of the magnetising current (off-load) of the motor.

Maximum power of the motor		Maximum speed rpm		
		3000	1500	1000
HP	kW	Max. power in kVAr		
11	8	2	2	3
15	11	3	4	5
20	15	4	5	6
25	18	5	7	7.5
30	22	6	8	9
40	30	7.5	10	11
50	37	9	11	12.5
60	45	11	13	14
100	75	17	22	25
150	110	24	29	33
180	132	31	36	38
218	160	35	41	44
274	200	43	47	53
340	250	52	57	63
380	280	57	63	70
482	355	67	76	86

If the capacitor power required to compensate the motor is greater than the values given in the above table or if, more generally: Qc > 90% Io$\sqrt{3}$ U, compensation at the motor terminals will however remain possible by inserting a contactor (C.2), controlled by an auxiliary contact of the motor contactor (C.1), in series with the capacitor.

The Legrand range of reactive energy compensations includes:

- Alpivar² & Alpican™ capacitors
- Reactors
- Power factor controllers
- Alpimatic racks
- Alpimatic & Alpistatic automatic capacitor banks

The Range

Alpivar²

- Conforms to IEC 60831-1&2
- Self healing metalized polypropylene film
- Double, class II insulation
- Self extinguishing polypropylene resin casing
- Very low loss factor
- Range: 1 to 125 KVAr

Alpican™

Resin filled

Gas filled

- Conforms to IS 13340-1993, IEC 60831-1&2
- ISI marked
- Metalized polypropylene film
- Explosion proof design
- Better heat dissipation
- Low losses
- Range:
  Resin filled- 1 to 30 KVAr
  Gas filled- 5 to 25 KVAr

Reactor

- High harmonics loading capability
- Very low losses
- Low noise
- Long expected life
- High linearity
- Range: 10 to 100 KVAr

Automatic Power Factor Controller

- Conforms to IEC 61010-1
- Intelligent control
- High accuracy
- Range: 3,5,7 & 12 steps

Alpimatic racks

- Conforms to IEC 60439-1
- Very low losses
- Long expected life
- Range: 12.5 to 75 KVAr

Alpimatic & Alpistatic automatic capacitor banks

- Conforms to IEC 60439-1&2
- Fully modular design
- IP 31, IK05 Cabinet
- Range: 10 to 900 KVAr

The Alpivar² range of capacitors includes:

- Alpivar² capacitors
- Alpimatic racks
- Alpimatic & Alpistatic automatic capacitor banks

Alpivar² capacitors

MAIN ADVANTAGES OF THE RANGE

Alpivar² capacitors

> Alpivar² capacitors are totally dry units that have been coated under vacuum, with triple electrical protection, for excellent resistance to overvoltages and partial discharges and a much longer service life than conventional units.

> The universal mounting ranges of Alpivar² automati racks are factory-wired and can be fitted in any type of cabinet to create automatic reactive energy compensation systems. Reactive power available up to 75 kVAr/step.

> Alpimatic & Alpistatic automatic capacitor banks are compact solutions, offering a fully modular design, for easy extension and maintenance and to meet all requirements: standard, H and SAH (standard class, reinforced and extra-reinforced class with detuned reactors). The power factor controller ensures easy commissioning. The Alpistatic range of automatic capacitor banks also provides real-time compensation.

Alpimatic racks

Alpimatic & Alpistatic automatic capacitor banks

Alpivar² capacitors

Alpivar²: VACUUM TECHNOLOGY CAPACITOR

Features of the range

Alpivar² patented capacitors are totally dry units with no impregnation, insulation liquid or gas.

They are designed by combining individual single phase windings, connected in a delta configuration, to produce a three-phase unit.

These windings are created using two polypropylene films with zinc coating on one side:

- The metal coating forms the electrode
- The polypropylene film forms the insulation

They are then **vacuum** coated with a self-extinguishing thermosetting polyurethane resin which forms the casing, providing mechanical and electrical protection.

This **vacuum** coating technique for the windings, which is unique to **Legrand,** gives **Alpivar²** capacitors excellent resistance over time and a much longer service life than conventional units.

Vacuum sealing ensures that there is no air or moisture near the windings. This design provides excellent resistance to overvoltages and partial discharges.
This unit complies fully with environmental protection requirements (PCB-free).

Type of capacitor

Monobloc or modular, the **Alpivar²** capacitor meets all user requirements.

The modular solution in particular, with its quick, easy assembly, can be used to create units with different power ratings, resulting in a significant reduction in storage costs for integrators and local distributors.

Installation

Its compact form makes it easy to install and significantly reduces the costs of cabinets and racks. The casing is particularly resistant to all solvents and atmospheric agents (rain, sun, salty air, etc.).

The **Alpivar²** capacitor is ideal for installations in corrosive atmospheres

Alpivar²: CONNECTION AND PROTECTION DEVICES

Connection

• The easy accessibility of the terminals on the top of the unit make the **Alpivar²** capacitor very easy to connect.

• The use of a system of "socket" terminals enables direct connection of the unit via cables and lugs.

• The **Alpivar²** double-insulated or class 2 capacitor does not need earthing.

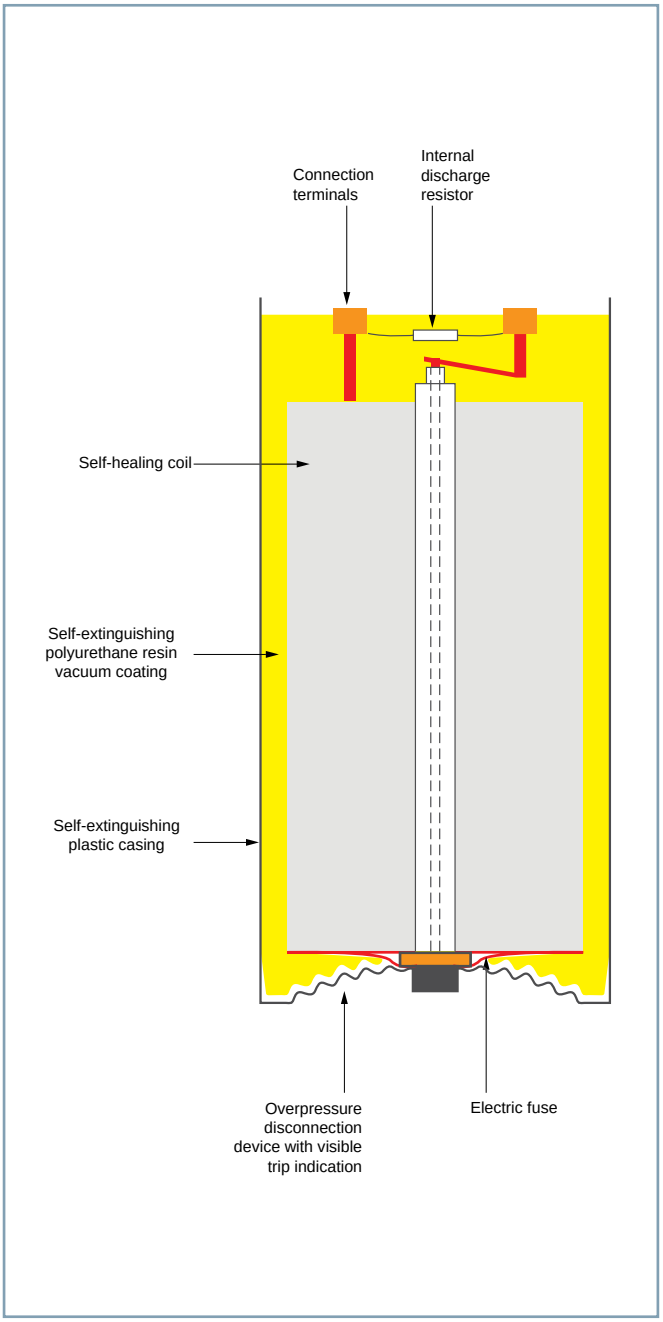
Electrical protection devices

• **Self-healing dielectric**: This self-healing property is connected with the characteristics of the metal deposit which forms the electrode and the nature of the insulating support (polypropylene film).
This special manufacturing technique prevents breakdown of the capacitor due to electrical overvoltages. In fact overvoltages perforate the dielectric and cause discharges which vaporise the metal near the short circuit, thus instantaneously restoring the electrical insulation.

• **Internal fuses**: One per winding.

• **Pressure monitoring devices**: If an electrical fault cannot be overcome by the film self-healing or by means of the electric fuse, gas is emitted, causing a membrane to deform and disconnecting the faulty winding. The triggering of the pressure monitoring devices is visible from outside the capacitor. This feature makes it easy to carry out a quick check on the status of the unit.

These three protection devices, together with the vacuum coating of the windings (technique patented by a group company of LEGRAND), result in a very high-tech unit.



Alpivar² capacitors

NEW

V7540CB

Technical characteristics (p. 28)

Double or class II insulation.
Totally dry self-extinguishing polyurethane resin casing.
Internal protection for each winding using:
- A self-healing metallised polypropylene film
- An electric fuse
- A disconnection device in case of overpressure

Colour: Casing RAL 7035
Cover RAL 7001
Conforming to IEC 60831-1 and 2

Standard duty, 3 phase, 440 V - 50 Hz

520 V max.
Harmonic pollution SH/ST ≤ 15%

Pack	Cat.Nos	Nominal power (kVAr)
1	V544CB	5
1	V1044CB	10
1	V12.544CB	12.5
1	V1544CB	15
1	V2044CB	20
1	V2544CB	25
1	V3044CB	30
1	V4044CB	40
1	V5044CB	50
1	V6044CB	60
1	V7544CB	75
1	V8044CB	80
1	V9044CB	90
1	V10044CB	100
1	V12544CB	125

Heavy duty, 3 phase, 440 V - 50 Hz

520 V max.
Harmonic pollution 15% < SH/ST ≤ 25%
Can be associated with 7% detuned reactors

Pack	Cat.Nos	Nominal power (kVAr)
1	VH2.544CB	2.5
1	VH544CB	5
1	VH7.544CB	7.5
1	VH1044CB	10
1	VH12.544CB	12.5
1	VH1544CB	15
1	VH2044CB	20
1	VH2544CB	25
1	VH3044CB	30
1	VH3544CB	35
1	VH4044CB	40
1	VH5044CB	50
1	VH6044CB	60
1	VH7544CB	75
1	VH8044CB	80
1	VH9044CB	90
1	VH10044CB	100
1	VH12544CB	125

Heavy duty capacitor with series reactor, 3 phase, 400 V - 50 Hz

Capacitor combined with an detuned reactor
Assembly fitted and wired in IP 31 - IK 05 cabinet
Conforming to standards EN and IEC 60831-1 and 2

Standard class - Max. 470 V
Harmonic pollution 25% < SH/ST ≤ 35%

Pack	Cat.Nos	Nominal power (kVAr)
1	VS5040.189	50
1	VS7540.189	75
1	VS10040.189	100
1	VS15040.189	150
1	VS20040.189	200
1	VS25040.189	250
1	VS30040.189	300

Reinforced class - Max. 520 V
Harmonic pollution 35% < SH/ST ≤ 50%

Pack	Cat.Nos	Nominal power (kVAr)
1	VS.R4040.189	40
1	VS.R8040.189	80
1	VS.R12040.189	120
1	VS.R16040.189	160
1	VS.R20040.189	200
1	VS.R24040.189	240
1	VS.R28040.189	280

Extra-reinforced class - Max. 620 V
Harmonic pollution SH/ST > 50%

Pack	Cat.Nos	Nominal power (kVAr)
1	VS.RS7240.189	72
1	VS.RS14440.189	144
1	VS.RS21640.189	216
1	VS.RS28840.189	288

Delivery within 4 - 8 weeks from the date of order. Red catalogue numbers : new products.

Alpimatic racks

P7540

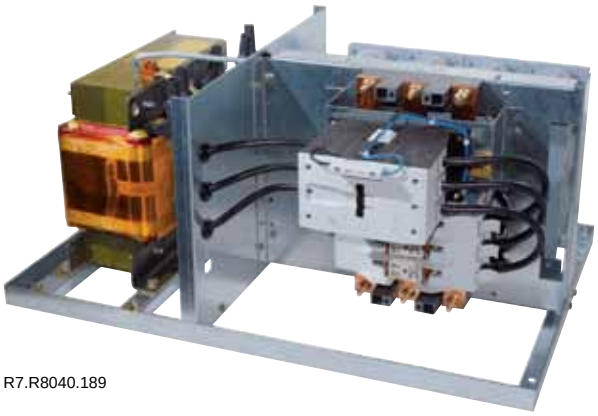
Factory connected units for integration in universal cabinets for automatic compensation systems
Standard and Heavy duty versions:
- 1 Alpivar² capacitor
- 1 contactor suitable for the capacitive currents
- 1 set of 3 HRC fuses
- 1 set of modular copper busbars with junction bars for connecting several racks
- 1 steel frame on which the components are assembled and wired

Pack	Cat.Nos	**Standard duty, 3 phase, 400 V - 50 Hz**
		470 V max.
		Harmonic pollution SH/ST ≤ 15%
		Nominal power (kVAr)
1	P12.540	12.5
1	P12.512.540	12.5+12.5
1	P2540	25
1	P252540	25+25
1	P255040	25+50
1	P5040	50
1	P7540	75

		Heavy duty, 3 phase, 400 V - 50 Hz
		520 V max.
		Harmonic pollution 15% < SH/ST ≤ 25%
		Nominal power (kVAr)
1	PH12.540	12.5
1	PH12.512.540	12.5+12.5
1	PH2540	25
1	PH252540	25+25
1	PH255040	25+50
1	PH5040	50
1	PH7540	75

NEW

Alpimatic racks with detuned reactors



R7.R8040.189

Factory connected units for integration in universal cabinets for automatic compensation systems
Heavy duty capacitor with series reactor versions (detuned reactors):
- 1 Alpivar² capacitor
- 1 contactor suitable for the capacitive currents
- 1 detuned reactor with thermal protection
- 1 set of 3 HRC fuses
- 1 set of modular copper busbars with junction bars for connecting several racks
- 1 steel frame on which the components are assembled and wired

Pack	Cat.Nos	**Heavy duty capacitor with series reactor, 3 phase, 400 V - 50 Hz**
		Standard class - Max. 470 V
		Harmonic pollution 25% < SH/ST ≤ 35%
		Nominal power (kVAr)
1	R5.2540.189	25
1	R5.5040.189	50
1	R7.5040.189	50
1	R7.7540.189	75
		Reinforced class - Max. 520 V
		Harmonic pollution 35% < SH/ST ≤ 50%
		Nominal power (kVAr)
1	R5.R4040.189	40
1	R7.R4040.189	40
1	R7.R404040.189	40+40
1	R7.R8040.189	80
		Extra-reinforced class - Max. 620 V
		Harmonic pollution SH/ST > 50%
		Nominal power (kVAr)
1	R9.RS7240.189	72

Delivery within 4 - 8 weeks from the date of order. Red catalogue numbers : new products.

Alpimatic & Alpistatic automatic capacitor banks

NEW

M6040

M20040

Dimensions (p. 31)

IP 31 - IK 05 cabinet
Fully modular design for easy extension and maintenance
Alpimatic is made up of one or several cabinets according to the capacitor bank model and the nominal current
The electromechanical contactors are controlled by the Alptec power controller with a simple commissioning procedure
Cable entry at the bottom (at the top on request)
Electrical parts protected against direct contact: IP 20 (door open)
Grey cabinet (RAL 7035) with black base Conforming to standards IEC 60439-1 and 2

Standard duty, 3 phase, 400 V - 50 Hz

470 V max.

Harmonic pollution SH/ST ≤ 15%

Pack	Cat.Nos	Nominal power (kVAr)	Steps (kVAr)
1	M1040	10	2x5
1	M1540	15	5+10
1	M2040	20	2x10
1	M2540	25	10+15
1	M3040	30	3x10
1	M3540	35	5+10+20
1	M4040	40	2x10+20
1	M5040	50	10+15+25
1	M6040	60	3x20
1	M7540	75	3x25
1	M87.540	87.5	12.5+25+50
1	M10040	100	2x25+50
1	M12540	125	25+2x50
1	M15040	150	25+50+75
1	M17540	175	2x25+50+75
1	M20040	200	50+2x75
1	M22540	225	25+50+2x75
1	M25040	250	2x50+2x75
1	M27540	275	25+2x50+2x75
1	M30040	300	25+50+3x75
1	M35040	350	50+4x75
1	M40040	400	2x50+4x75
1	M45040	450	6x75
1	M50040	500	50+6x75
1	M55040	550	2x50+6x75
1	M60040	600	8x75
1	M67540	675	9x75
1	M75040	750	10x75
1	M82540	825	11x75
1	M90040	900	12x75

Heavy duty, 3 phase, 400 V - 50 Hz

520 V max.

Harmonic pollution 15% < SH/ST ≤ 25%

Pack	Cat.Nos	Nominal power (kVAr)	Steps (kVAr)
1	MH1040	10	2x5
1	MH1540	15	5+10
1	MH2040	20	2x10
1	MH2540	25	10+15
1	MH3040	30	3x10
1	MH3540	35	5+10+20
1	MH4040	40	2x10+20
1	MH5040	50	10+15+25
1	MH6040	60	3x20
1	MH7540	75	3x25
1	MH87.540	87.5	12.5+25+50
1	MH10040	100	2x25+50
1	MH12540	125	25+2x50
1	MH15040	150	25+50+75
1	MH17540	175	2x25+50+75
1	MH20040	200	50+2x75
1	MH22540	225	25+50+2x75
1	MH25040	250	2x50+2x75
1	MH27540	275	25+2x50+2x75
1	MH30040	300	25+50+3x75
1	MH35040	350	50+4x75
1	MH40040	400	2x50+4x75
1	MH45040	450	6x75
1	MH50040	500	50+6x75
1	MH55040	550	2x50+6x75
1	MH60040	600	8x75
1	MH67540	675	9x75
1	MH75040	750	10x75
1	MH82540	825	11x75
1	MH90040	900	12x75

Delivery within 4 - 8 weeks from the date of order. Red catalogue numbers : new products.

Alpimatic & Alpistatic automatic capacitor banks (continued)

NEW

MS30040.189

MS.R40040.189

Heavy duty capacitor with series reactor, 3 phase, 400 V - 50 Hz

Standard class - Max. 470 V

Harmonic pollution 25% < SH/ST ≤ 35%

Pack	Cat.Nos	Nominal power (kVAr)	Steps (kVAr)
1	MS7540.189	75	25+50
1	MS10040.189	100	2x25+50
1	MS12540.189	125	25+2x50
1	MS15040.189	150	3x50
1	MS20040.189	200	50+2x75
1	MS22540.189	225	3x75
1	MS25040.189	250	2x50+2x75
1	MS27540.189	275	50+3x75
1	MS30040.189	300	4x75
1	MS35040.189	350	50+4x75
1	MS37540.189	375	5x75
1	MS45040.189	450	6x75
1	MS52540.189	525	7x75
1	MS60040.189	600	8x75
1	MS67540.189	675	9x75
1	MS75040.189	750	10x75

Reinforced class - Max. 520 V

Harmonic pollution 35% < SH/ST ≤ 50%

Pack	Cat.Nos	Nominal power (kVAr)	Steps (kVAr)
1	MS.R12040.189	120	3x40
1	MS.R16040.189	160	2x40+80
1	MS.R20040.189	200	40+2x80
1	MS.R24040.189	240	2x40+2x80
1	MS.R28040.189	280	40+3x80
1	MS.R32040.189	320	4x80
1	MS.R36040.189	360	40+4x80
1	MS.R40040.189	400	5x80
1	MS.R44040.189	440	40+5x80
1	MS.R48040.189	480	6x80
1	MS.R52040.189	520	40+6x80
1	MS.R56040.189	560	7x80
1	MS.R60040.189	600	40+7x80
1	MS.R64040.189	640	8x80
1	MS.R72040.189	720	9x80
1	MS.R80040.189	800	10x80

Heavy duty capacitor with series reactor, 3 phase, 400 V - 50 Hz (continued)

Extra-reinforced class - Max. 620 V

Harmonic pollution SH/ST > 50%

Pack	Cat.Nos	Nominal power (kVAr)	Steps (kVAr)
1	MS.RS14440.189	144	2x72
1	MS.RS21640.189	216	3x72
1	MS.RS28840.189	288	4x72
1	MS.RS36040.189	360	5x72
1	MS.RS43240.189	432	6x72
1	MS.RS50440.189	504	7x72
1	MS.RS57640.189	576	8x72
1	MS.RS64840.189	648	9x72
1	MS.RS72040.189	720	10x72
1	MS.RS79240.189	792	11x72
1	MS.RS86440.189	864	12x72

Alpivar²

Guarantee

- The Company at its discretion will replace products if they have any manufacturing defect within 1 year for capacitor, Reactor & APFC controller.
- The above guarantee is applicable when the products are selected taken into consideration all the technical characteristics of the product published in our catalogue.
- The guarantee is only applicable when the products are installed as per the Company's instructions and not tampered in any manner.
- The guarantee states the Company's entire liability. It does not extend to cover consequential loss or damage or installation costs arising from defective products.

Delivery within 4 - 8 weeks from the date of order. Red catalogue numbers : new products.

Alpivar² capacitors

■ Technical specifications

Discharge resistors
Fitted inside, these discharge the unit in accordance with current standards (discharge time, 3 minutes)

Loss factor
Alpivar² capacitors have a loss factor of less than 0.1×10^{-3}
This value leads to a power consumption of less than 0.3 W per kVAr, including the discharge resistors.

Capacitance
Tolerance on the capacitance value: + 5%
Our manufacturing process, which avoids any inclusion of air in the coils, ensures excellent stability of the capacitance throughout the service life of the Alpivar² capacitor.

Maximum permissible voltage: 1.18 Un

Maximum permissible current:
• Standard type: 1.3 In
• H type: 1.5 In

Insulation class
• Withstand at 50 Hz for 1 min: 6 kV
• 1.2/50 µs impulse withstand: 25 kV

Standards
Alpivar² capacitors comply with:
• French standard: NF C 54 108 and 109
• European standard: EN 60831-1 and 2
• International standard: IEC 60831-1 and 2
• Canadian standard: CSA 22-2 No. 190

Temperature class
Alpivar² capacitors are designed for a standard temperature class -25/+55°C
• Maximum temperature: 55°C
• Average over 24 hours: 45°C
• Annual average: 35°C

• Peak inrush current : 400 A
• Mean life expectancy : 10 years
• Switching Operations : 10000 per year
• Impregnation : Dry Resin

Alpivar² racks

■ Technical specifications

Loss factor
Standard and Heavy duty type Alpimatic racks have a loss factor of 2 W/kVAr,
while that of Heavy duty capacitor with series reactor type racks is 6 W/kVAr

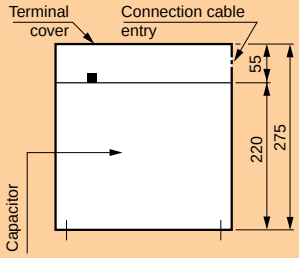
Standards
• International standard: IEC 60439-1
• European standard: EN 60439-2

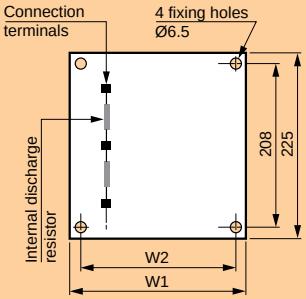
Temperature class
• Operation: -10 to +45°C (average over 24 hours: 40°C)
• Storage: -30 to +60°C

Alpivar² capacitors

■ Dimensions

Standard duty / Heavy duty - 3 phase





Standard duty	Heavy duty	Dimensions (mm)			Weight (kg)
		W1	W2	H	
	VH2.540CB	90	70	275	3.5
V544CB	VH540CB	90	70	275	3.5
V1044CB	VH7.540CB	90	70	275	3.5
V12.544CB	VH1040CB	90	70	275	3.5
V1544CB	VH12.540CB	90	70	275	3.5
V2044CB	VH1540CB	90	70	275	3.5
V2544CB	VH2040CB	90	70	275	3.5
V3044CB	VH2540CB	90	70	275	3.5
V4044CB	VH3040CB	180	156	275	7
V5044CB	VH3540CB	180	156	275	7
V6044CB	VH4040CB	180	156	275	7
V7044CB	VH5040CB	180	156	275	7
V8044CB	VH6040CB	270	244	275	10.5
V9044CB	VH7540CB	270	244	275	10.5
V10044CB	VH8040CB	360	332	275	14
V12544CB	VH9040CB	360	332	275	14
	VH10040CB	360	332	275	14
	VH12540CB	450	419	275	17.5

Heavy duty capacitor with series reactor, standard class - 3 phase

Cat.Nos	Dimensions (mm)			Weight (kg)
	Height	Width	Depth	
VS5040.189	1400	600	500	120
VS7540.189	1400	600	500	140
VS10040.189	1400	600	500	160
VS15040.189	1400	600	500	180
VS20040.189	1900	800	500	250
VS25040.189	1900	800	500	275
VS30040.189	1900	800	500	300

Heavy duty capacitor with series reactor, reinforced class - 3 phase

Cat.Nos	Dimensions (mm)			Weight (kg)
	Height	Width	Depth	
VS.R4040.189	1400	600	500	120
VS.R8040.189	1400	600	500	150
VS.R12040.189	1400	600	500	180
VS.R16040.189	1900	800	500	220
VS.R20040.189	1900	800	500	260
VS.R24040.189	1900	800	500	280
VS.R28040.189	1900	800	500	300

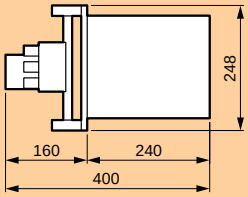
Heavy duty capacitor with series reactor, extra-reinforced class - 3 phase

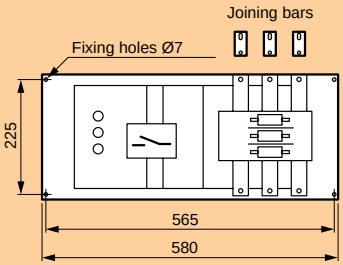
Cat.Nos	Dimensions (mm)			Weight (kg)
	Height	Width	Depth	
VS.RS7240.189	2100	1000	600	180
VS.RS14440.189	2100	1000	600	250
VS.RS21640.189	2100	1000	600	320
VS.RS28840.189	2100	1000	600	380

All dimensions are in mm, 1 Inch = 25.4mm, accuracy of dimensions = ± 2mm

Alpivar² racks

■ Dimensions





Standard duty

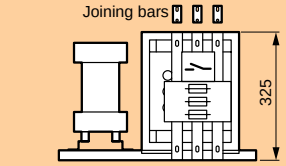
	Weight (kg)
P12.540	6
P12.512.540	11
P2540	9
P252540	16
P255040	22
P5040	16
P7540	22

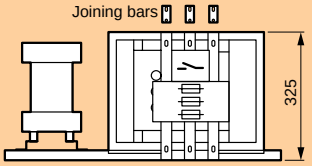
Heavy duty

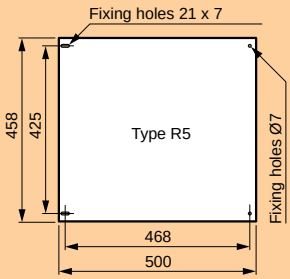
	Weight (kg)
PH12.540	7
PH12.512.540	14
PH2540	10
PH252540	17
PH255040	23
PH5040	17
PH7540	23

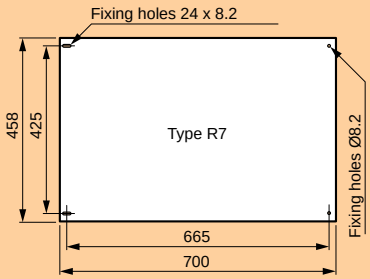
Alpivar² racks with detuned reactors

■ Dimensions







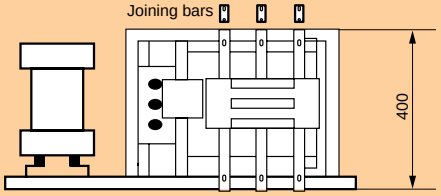


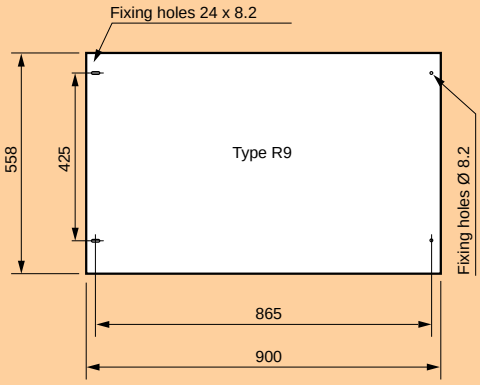
Standard class

	Weight (kg)
R5.2540.189	45
R5.5040.189	50
R7.5040.189	55
R7.7540.189	60

Reinforced class

	Weight (kg)
R5.R4040.189	50
R7.R4040.189	52
R7.R404040.189	65
R7.R8040.189	65





Extra-reinforced class

	Weight (kg)
R9.RS7240.189	80

All dimensions are in mm, 1 Inch = 25.4mm, accuracy of dimensions = ± 2mm

Alpimatic & Alpistatic automatic capacitor banks
400 V network

■ Dimensions

Standard duty- 3 phase

Cat.Nos	Dimensions (mm)			Weight (kg)
	Height	Width	Depth	
M1040	650	260	320	40
M1540	650	260	320	40
M2040	650	260	320	40
M2540	650	260	320	40
M3040	650	260	320	45
M3540	650	260	320	45
M4040	650	260	320	45
M5040	650	260	320	45
M6040	770	260	320	50
M7540	770	260	320	75
M87.540	1000	350	500	80
M10040	1000	350	500	80
M12540	1000	350	500	90
M15040	1400	600	500	125
M17540	1400	600	500	140
M20040	1400	600	500	150
M22540	1400	600	500	160
M25040	1400	600	500	170
M27540	1400	600	500	190
M30040	1400	600	500	200
M35040	1900	600	500	260
M40040	1900	600	500	290
M45040	1900	600	500	300
M50040	1400	1200	500	370
M55040	1400	1200	500	400
M60040	1400	1200	500	430
M67540	1900	1200	500	490
M75040	1900	1200	500	500
M82540	1900	1200	500	540
M90040	1900	1200	500	560

Heavy duty - 3 phase

Cat.Nos	Dimensions (mm)			Weight (kg)
	Height	Width	Depth	
MH1040	650	260	320	40
MH1540	650	260	320	40
MH2040	650	260	320	40
MH2540	650	260	320	40
MH3040	650	260	320	45
MH3540	650	260	320	45
MH4040	650	260	320	45
MH5040	650	260	320	45
MH6040	770	260	320	50
MH7540	770	260	320	75
MH87.540	1000	350	500	80
MH10040	1000	350	500	80
MH12540	1000	350	500	90
MH15040	1400	600	500	125
MH17540	1400	600	500	140
MH20040	1400	600	500	150
MH22540	1400	600	500	160
MH25040	1400	600	500	170
MH27540	1400	600	500	190
MH30040	1400	600	500	200
MH35040	1900	600	500	260
MH40040	1900	600	500	290
MH45040	1900	600	500	300
MH50040	1400	1200	500	310
MH55040	1400	1200	500	370
MH60040	1400	1200	500	420
MH67540	1900	1200	500	450
MH75040	1900	1200	500	500
MH82540	1900	1200	500	550
MH 90040	1900	1200	500	600

■ Dimensions

Heavy duty capacitor with series reactor, standard class - 3 phase

Cat.Nos	Dimensions (mm)			Weight (kg)
	Height	Width	Depth	
MS7540.189	1400	600	500	180
MS10040.189	1400	600	500	230
MS12540.189	1400	600	500	250
MS15040.189	1400	600	500	300
MS20040.189	1900	800	500	340
MS22540.189	1900	800	500	360
MS25040.189	1900	800	500	380
MS27540.189	1900	800	500	400
MS30040.189	1900	800	500	420
MS35040.189	2100	800	500	460
MS37540.189	2100	800	500	470
MS45040.189	1900	1600	500	600
MS52540.189	1900	1600	500	630
MS60040.189	1900	1600	500	730
MS67540.189	2100	1600	500	800
MS75040.189	2100	1600	500	860

Heavy duty capacitor with series reactor, reinforced class - 3 phase

Cat.Nos	Dimensions (mm)			Weight (kg)
	Height	Width	Depth	
MS.R12040.189	1400	600	500	250
MS.R16040.189	1900	800	500	300
MS.R20040.189	1900	800	500	340
MS.R24040.189	1900	800	500	370
MS.R28040.189	1900	800	500	400
MS.R32040.189	1900	800	500	430
MS.R36040.189	2100	800	500	470
MS.R40040.189	2100	800	500	520
MS.R44040.189	1900	1600	500	600
MS.R48040.189	1900	1600	500	630
MS.R52040.189	1900	1600	500	670
MS.R56040.189	1900	1600	500	700
MS.R60040.189	1900	1600	500	750
MS.R64040.189	1900	1600	500	800
MS.R72040.189	2100	1600	500	860
MS.R80040.189	2100	1600	500	920

Heavy duty capacitor with series reactor, extra-reinforced class - 3 phase

Cat.Nos	Dimensions (mm)			Weight (kg)
	Height	Width	Depth	
MS.RS14440.189	2100	1000	600	300
MS.RS21640.189	2100	1000	600	380
MS.RS28840.189	2100	1000	600	460
MS.RS36040.189	2100	2000	600	600
MS.RS43240.189	2100	2000	600	680
MS.RS50440.189	2100	2000	600	760
MS.RS57640.189	2100	2000	600	820
MS.RS64840.189	2100	3000	600	950
MS.RS72040.189	2100	3000	600	1130
MS.RS79240.189	2100	3000	600	1200
MS.RS86440.189	2100	3000	600	1260

All dimensions are in mm, 1 Inch = 25.4mm, accuracy of dimensions = ± 2mm

The Alpican™ range of capacitors includes:

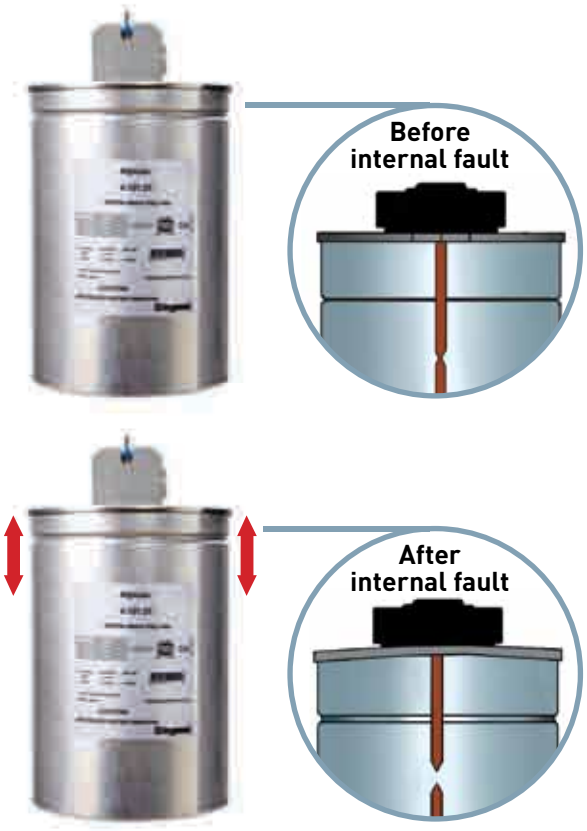
- **Resin filled - Standard duty & Heavy duty capacitors**
- **Gas filled - Heavy duty capacitors**

Alpican™ capacitors

FEATURES

Explosion proof design

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. The specially designed can with expansion bead moves upwards. This expansion above certain limit breaks the internal fuse and capacitor is disconnected from the circuit and the flow of current is interrupted. Thus the overpressure dis-connector protects the capacitor from explosion.



Alpican™ 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.

Unique terminal design

Unique terminal design with discharge resistor ensures proper termination of the cables. The cable connection is so firm that it doesn't allow the cable to losen.

Compact design

Alpican 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 Alpican™ 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.

Zero Maintenance

Design and manufacturing process makes Alpican™ maintenance free. This also ensures capacitance stability and long life. It adds value to the product and makes installation error free

Better heat dissipation

The Aluminium can design make heat dissipation uniform.

Low energy loss (energy saving)

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

Alpican™
resin filled capacitors

NEW

Alpican™
gas filled capacitors

4151 10

4151 23

4151 29

Dimensions (p. 40)
Technical data (p. 38)

Resin filled 440 V Standard duty:
- Conforms to IS 13340-1, 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
- Bio-degradable soft resin, semi-dry

Resin filled 440 V Heavy duty:
- Conforms to IS 13340-1, 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
- Bio-degradable soft resin, semi-dry

Dimensions (p. 40)
Technical data (p. 38)

Gas filled 440 V Heavy duty:
- Conforms to IS 13340-1, IEC 60831-1&2
- Compact design
- Self healing metallized polypropylene film
- Over pressure device for disconnection
- Low energy losses
- Dry inert gas filled

Pack	Cat. nos.	Standard duty Resin filled capacitor 440 V, 3 phase, 50 Hz
1/12	4151 00	1 KVAr
1/12	4151 01	2.1 KVAr
1/12	4151 02	3 KVAr
1/12	4151 03	4.2 KVAr
1/12	**4151 04**	5 KVAr
1/6	4151 05	7.5 KVAr
1/4	**4151 06**	10 KVAr
1/4	4151 07	12.5 KVAr
1/4	**4151 08**	15 KVAr
1/4	**4151 09**	20 KVAr
1/4	4151 10	25 KVAr
1/4	4151 11	30 KVAr

Pack	Cat. nos.	Heavy duty Resin filled capacitor 440 V 3 phase
1/12	4151 12	1 KVAr
1/12	4151 13	2.1 KVAr
1/6	4151 14	3 KVAr
1/6	4151 15	4.2 KVAr
1/6	**4151 16**	5 KVAr
1/4	4151 17	7.5 KVAr
1/4	**4151 18**	10 KVAr
1/4	4151 19	12.5 KVAr
1/2	**4151 20**	15 KVAr
1/4	**4151 21**	20 KVAr
1/2	4151 22	25 KVAr
1/2	4151 23	30 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

Bold catalogue numbers are products normally available with Legrand (India) stockists. **Cat. nos. that are not bold** - delivery within 4 - 8 weeks from the date of order.
Bold packing quantity is our mandatory packing. Orders to be placed by Legrand (India) stockists in multiples of the same.
Red catalogue numbers : new products.

Alpican™
resin filled capacitor for reactors

NEW

Reactors and Power factor controllers

4151 33

4151 50

4150 43

Dimensions (p. 41)
Technical data (p. 38)

Resin filled 525 V Standard duty:
- Conforms to IS 13340-1, IEC 60831-1&2
- Compact design
- Self healing metallized polypropylene film
- Over pressure device for disconnection
- Low energy losses
- Resistance to high temperatures
- Bio-degradable soft resin, semi-dry

Pack	Cat. nos.	Standard duty Resin filled capacitor 525 V, 3 phase, 50Hz
1/6	4151 32	5 KVAr
1/4	4151 33	8.3 KVAr
1/4	4151 34	10.4 KVAr
1/4	4151 35	12.5 KVAr
1/4	4151 36	16.7 KVAr
1/4	4151 37	20.8 KVAr
1/4	4151 38	25 KVAr

Dimensions (p. 41-42)
Technical data (p. 40)

Reactor:
- High harmonic loading capacity
- Low losses
- High linearity
- Easy mounting

Automatic power factor controller:
- 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
- Internal temperature sensor
- RS 232 communication port
- In-built LED screens

Pack	Cat. nos.	Reactors 7 % duty
1	4151 48	Reactor 10 kvar
1	4151 49	Reactor 12.5 kvar
1	4151 50	Reactor 25 kvar
1	4151 51	Reactor 50 kvar
1	4151 52	Reactor 100 kvar

		Reactors 14 % duty
1	4151 53	Reactor 12.5 kvar
1	4151 54	Reactor 25 kvar
1	4151 55	Reactor 50 kvar

		Power factor controller
1	4150 52	3 step controller
1	4150 41	5 step controller
1	4150 42	7 step controller
1	4150 43	12 step controller

Alpican™

Guarantee

- The Company at its discretion will replace products if they have any manufacturing defect within 1 year for capacitor, Reactor & APFC controller.
- The above guarantee is applicable when the products are selected taken into consideration all the technical characteristics of the product published in our catalogue.
- The guarantee is only applicable when the products are installed as per the Company's instructions and not tampered in any manner.
- The guarantee states the Company's entire liability. It does not extend to cover consequential loss or damage or installation costs arising from defective products.

Bold catalogue numbers are products normally available with Legrand (India) stockists. **Cat. nos. that are not bold** - delivery within 4 - 8 weeks from the date of order.
Bold packing quantity is our mandatory packing. Orders to be placed by Legrand (India) stockists in multiples of the same.
Red catalogue numbers : new products.

Alpican™
Resin filled Standard duty & Heavy duty capacitors

■ Technical specifications

Resin filled Standard duty capacitors

- Standards : IS 13340-1993, IS 13341-1992, IEC-60831-1&2
- Rated Voltage : 440 V & 525 V
- Frequency : 50/60 Hz
- Power range : 1 to 30 KVAr
- Losses(Dielectrical) : < 0.20 W/KVAr
- Losses (Total) : < 0.45 W/KVAr
- Peak inrush current : 200*In
- Over voltage : UN+10% for 8 Hrs in 24 Hrs
- Over current : 1.3 * In
- Mean life expectancy : upto1,00,000 h at temp level D
- Capacitance tolerance : +10%
- Voltage test between terminals : 1.75*Un , AC, 2S as per IS
- Voltage test between earth & terminals : 3.6 KV, AC, 2S as per IS
- Discharge resistors : Fitted: standard discharge time less than at residual voltage of 50V, 60 second as per IS
- Safety : Self healing + pressure sensitive disconnector + discharge device
- Protection : IP20
- Casing : Aluminium Can
- Dielectric : Metallized Polypropylene film
- Impregnation : NCPB Soft polyurethene Resin
- Ambient temperature : -10°C / + 55°C (Class D)
- Humidity : 95%
- Altitude : 4000 m above sea level
- Mounting : Indoor,vertical position
- Fixing and earthing : Threaded M12 stud at bottom
- Switching life : Maximum 5000 per year

Resin filled Heavy duty capacitors

- Standards : IS 13340-1993, IS 13341-1992, IEC 60831-1/-2, IEC-60831-1&2
- Rated Voltage : 440 V
- Frequency : 50/60 Hz
- Power range : 1 to 30 KVAr
- Losses(Dielectrical) : < 0.20 W/KVAr
- Losses (Total) : < 0.5 W/KVAr
- Peak inrush current : 250*In
- Over voltage : UN+10% for 8 Hrs in 24 Hrs
- Over current : 1.5 to 1.8 * In
- Mean life expectancy : upto 1,15,000 h at temp level D
- Capacitance tolerance : +10%
- Voltage test between terminals : 1.75*Un , AC, 2S as per IS
- Voltage test between earth & terminals : 3.6 KV, AC, 2S as per IS
- Discharge resistors : Fitted: standard discharge time less than at residual voltage of 50V, 60 second as per IS
- Safety : Self healing + pressure sensitive disconnector + discharge device
- Protection : IP20
- Casing : Aluminium Can
- Dielectric : Metallized Polypropylene film
- Impregnation : NCPB Soft polyurethene Resin
- Ambient temperature : -10°C / + 55°C (Class D)
- Humidity : 95%
- Altitude : 4000 m above sea level
- Mounting : Indoor,vertical position
- Fixing and earthing : Threaded M12 stud at bottom
- Switching life : Maximum 6000 per year

Alpican™
Gas filled Heavy duty capacitors

■ Technical specifications

- Standards : IS 13340-1993, IS 13341-1992, IEC 60831-1/-2, IEC-60831-1&2
- Rated Voltage : 440 V
- Frequency : 50/60 Hz
- Power range : 5 to 25 KVAr
- Losses(Dielectrical) : < 0.20 W/KVAr
- Losses (Total) : < 0.5 W/KVAr
- Peak inrush current : 300*In
- Over voltage : UN+10% for 8 Hrs in 24 Hrs
- Over current : 1.4 * In
- Mean life expectancy : upto 1,80,000 h at temp level C
- Capacitance tolerance : -5/10%
- Voltage test between terminals : 1.75*Un , AC, 2S as per IS
- Voltage test between earth & terminals : 3.6 KV, AC, 2S as per IS
- Discharge resistors : Fitted: standard discharge time less than at residual voltage of 50V, 60 second as per IS
- Safety : Self healing + pressure sensitive disconnector + discharge device
- Protection : IP20
- Casing : Aluminium Can
- Dielectric : Metallized Polypropylene film
- Impregnation : Inert gas impregnated
- Ambient temperature : --40°C / + 55°C (Class D)
- Humidity : 95%
- Altitude : 4000 m above sea level
- Mounting : Indoor,vertical position
- Fixing and earthing : Threaded M12 stud at bottom
- Switching life : Maximum 7000 per year

Reactors

■ Technical specifications

- Standard: IEC 60076-6
- Rated line voltage: 440V
- Rated frequency: 50Hz
- De-tuning factor p [%]: 7 %
- Tolerance on inductance: 0/+6%
- Dielectric test: 50Hz3kV, 60s
- Protection class: IP 00
- Cooling method: natural air (AN)
- Ambient temperature: +40°C
- Insulation class: H
- Insulation level: 1.1kV
- Blocking factor p% 7% - Tuning order 3.78
- Temperature protection (NC) : Yes

Power factor controllers

■ Technical specifications

- Digital power factor controller
- LED screen: 3 digits, 7 segments
- Membrane keypad
- RS 232 serial port for setting parameters and automatic testing via a PC
- Internal temperature sensor
- Advanced function for measuring capacitor overvoltages, average over a week
- 1 programmable relay for an alarm and/or controlling a fan

Versions
- 3, 5, 7 and 12 controlled steps

Temperature class
- Operation: - 10 to + 60°C
- Storage: - 20 to + 80°C

Current inputs
Rated current: 5 A (1 A on request)
Operating limit: 0.125 A to 6 A
Input current: 0.65 W
Not sensitive to the CT polarity
Not sensitive to the phase rotation polarity

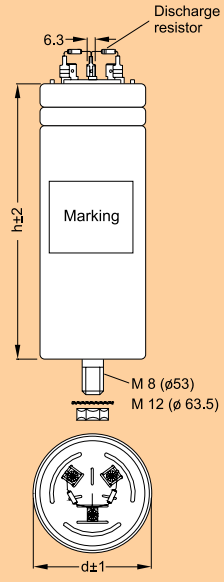
Frequency
50 Hz/60 Hz

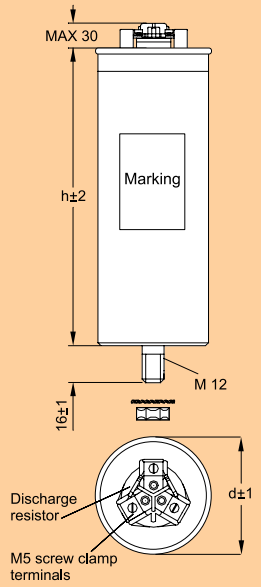
Parameters
Power factor: 0.8 inductive to 0.8 capacitive
Same step reconnection time: 5 to 240 s
Manual and automatic mode
4 quadrant operation for operation on generator
Internal temperature sensor
Volt-free contact for remote alarm
Alarm display (overvoltage, over/under compensation, overload, etc.)

Alpican™
resin filled capacitors

Alpican™
gas filled capacitors

■ Dimensions



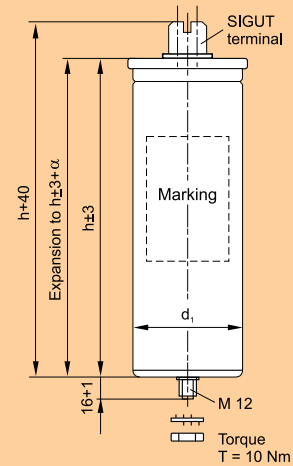


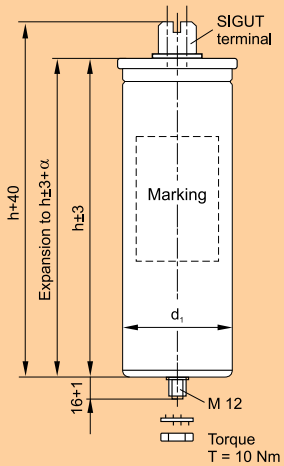
440 V Resin filled std duty

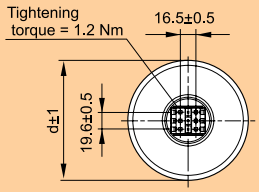
Cat no	Dimensions	
	Diameter	Height
4 151 00	53	117
4 151 01	53	117
4 151 02	63.5	129
4 151 03	63.5	129
4 151 04	63.5	152

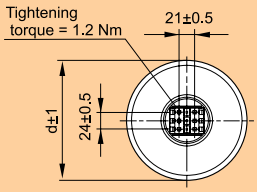
440 V Resin filled std duty

Cat no	Dimensions	
	Diameter	Height
4 151 05	78.4	195
4 151 06	88.4	195
4 151 07	88.4	270
4 151 08	88.4	270
4 151 09	88.4	345
4 151 10	93.5	345
4 151 11	93.5	345









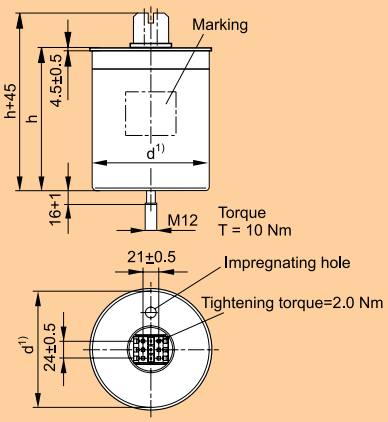
440 V Resin filled heavy duty
Can diameter up to 90 mm

Cat no	Dimensions	
	Diameter	Height
4 151 12	53	117
4 151 13	63.5	129
4 151 14	78.4	195
4 151 15	78.4	195
4 151 16	78.4	195
4 151 17	88.4	270
4 151 18	88.4	270

440 V Resin filled heavy duty
Can diameter above 90 mm

Cat no	Dimensions	
	Diameter	Height
4 151 19	93.5	270
4 151 20	105.5	280
4 151 21	121.5	280
4 151 22	121.5	325
4 151 23	142	325

■ Dimensions



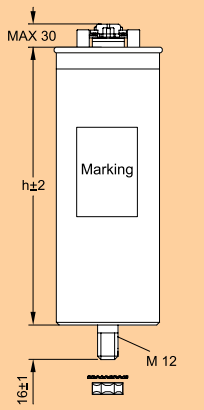
Creepage distance 12.7 mm min.
Clearance 9.6 mm min.

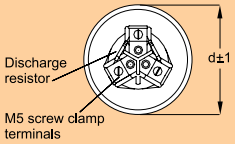
440 V Gas filled heavy duty

Cat no	Dimensions	
	Diameter	Height
4 151 24	116	164
4 151 25	116	164
4 151 26	116	164
4 151 27	116	164
4 151 28	116	164
4 151 29	116	200
4 151 30	136	200
4 151 31	136	200

All dimensions are in mm, 1 Inch = 25.4mm, accuracy of dimensions = ± 2mm

■ Dimensions





525 V Resin filled std duty

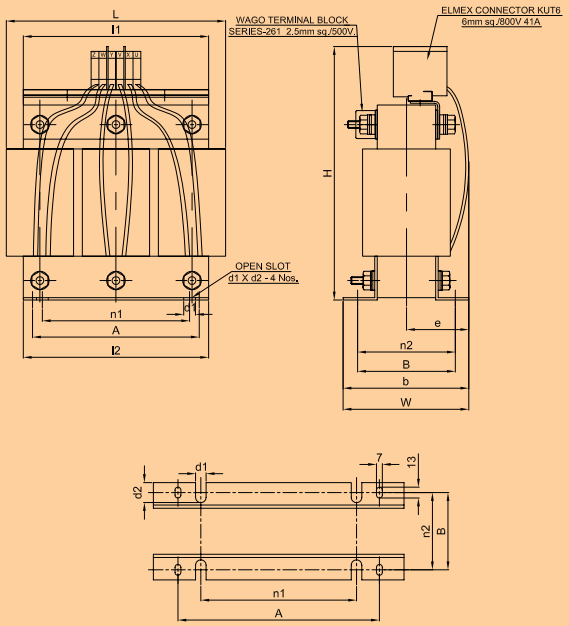
Cat no	Dimensions	
	Diameter	Height
4 151 32	78.4	195
4 151 33	88.4	270
4 151 34	88.4	270
4 151 35	88.4	270
4 151 36	88.4	345
4 151 37	93.5	345
4 151 38	93.5	345

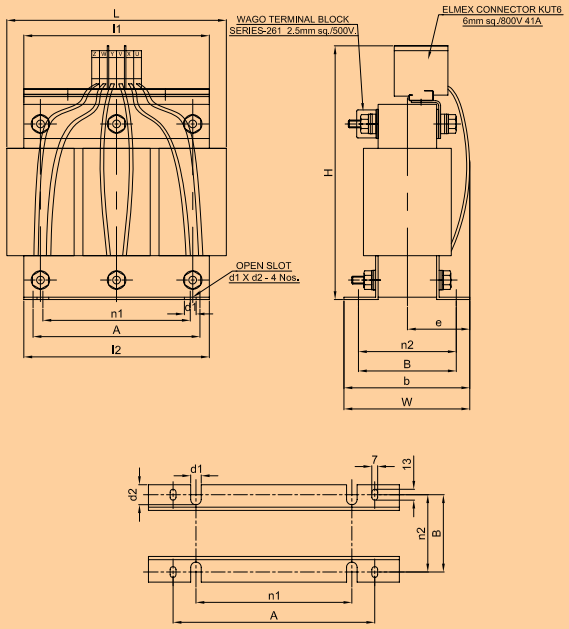
■ Dimensions

Cat.Nos	Height x Width x Depth (mm)	Weight (kg)
4 150 52	96 x 96 x 65	0.42
4 150 41	96 x 96 x 65	0.44
4 150 42	96 x 96 x 65	0.46
4 150 43	144 x 144 x 65	0.77

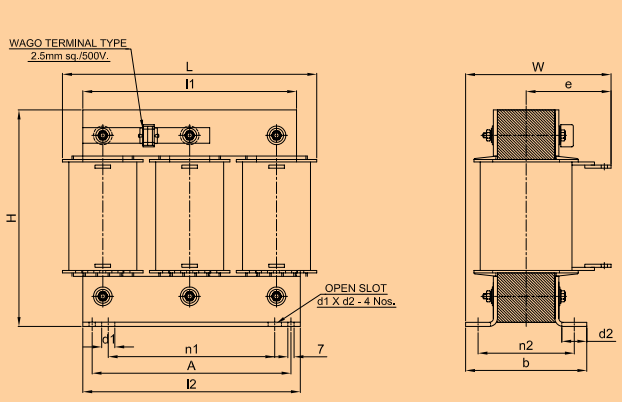
All dimensions are in mm, 1 Inch = 25.4mm, accuracy of dimensions = ± 2mm

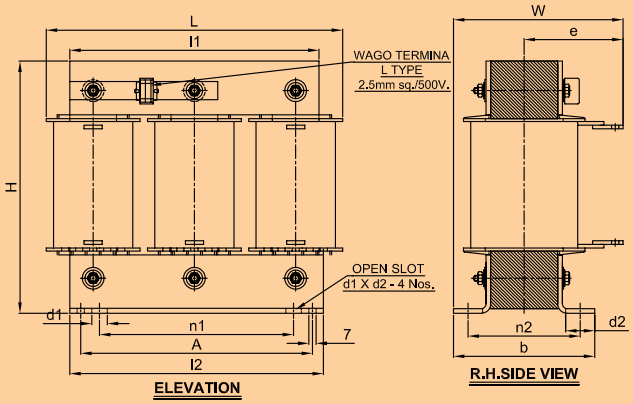
■ Dimensions

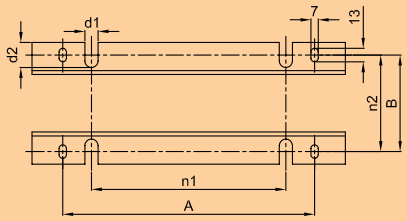


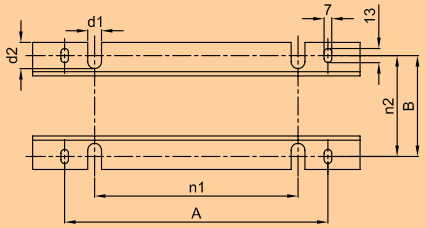


Cat no	KVAR	Rated Current	L	W	H	l1	l2	n1	n2	b	e	d1	d2	A	B
4151 48	10	13.2A.	190	140±3mm	225	165	165	60	78±3mm	100	90±5mm	10.8	15.5	85	78
4151 49	12.5	16.4A.	190	140±3mm	225	165	165	60	78±3mm	100	90±5mm	10.8	15.5	85	78









Cat no	KVAR	Rated Current	L	W	H	l1	l2	n1	n2	b	e	d1	d2	A	B
4151 50	25	32.8A.	240	165±5mm	205	205	205	150	95±3mm	114	115±5mm	10.8	15.5	175	95
4151 51	50	65.61.A.	275	225±5mm	240	235	235	150	165±3mm	185	127±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

All dimensions are in mm, 1 Inch = 25.4mm, accuracy of dimensions = ± 2mm

Contactors

Contactors compatable with Legrand capacitors

Standard duty 440V (resin)

Cat. No.	KVAR	Current	Contactor Cat. No.
4151 00	1 KVAr	1.3	J101211
4151 01	2.1 KVAr	2.8	J101211
4151 02	3 KVAr	3.9	J101211
4151 03	4.2 KVAr	5.5	J101211
4151 04	5 KVAr	6.6	J101211
4151 05	7.5 KVAr	9.8	J101211
4151 06	10 KVAr	13.1	J101211
4151 07	12.5 KVAr	16.4	J101811
4151 08	15 KVAr	19.7	J101811
4151 09	20 KVAr	26.2	J102011
4151 10	25 KVAr	32.8	J103021
4151 11	30 KVAr	39.4	J103021

Heavy duty 440V (resin)

Cat. No.	KVAR	Current	Contactor Cat. No.
4151 12	1 KVAr	1.3	J101211
4151 13	2.1 KVAr	2.8	J101211
4151 14	3 KVAr	3.9	J101211
4151 15	4.2 KVAr	5.5	J101211
4151 16	5 KVAr	6.6	J101211
4151 17	7.5 KVAr	9.8	J101211
4151 18	10 KVAr	13.1	J101211
4151 19	12.5 KVAr	16.4	J101811
4151 20	15 KVAr	19.7	J101811
4151 21	20 KVAr	26.2	J102011
4151 22	25 KVAr	32.8	J103021
4151 23	30 KVAr	39.4	J103021

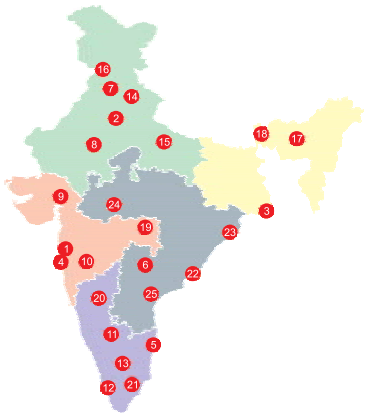
Heavy duty 440V (gas)

Cat. No.	KVAR	Current	Contactor Cat. No.
4151 24	5.2 KVAr	6.8	J101211
4151 25	7.5 kvar	9.6	J101211
4151 26	8.8 kvar	11.5	J101211
4151 27	11.5 kvar	13.8	J101211
4151 28	12.6 kvar	16.5	J101811
4151 29	17.5 kvar	23	J101811
4151 30	21 kvar	27.6	J102011
4151 31	25.2 kvar	33.1	J103021

Standard duty 525V (resin)

Cat. No.	KVAR	Current	Contactor Cat. No.
4151 32	5 KVAr	5.5	J101211
4151 33	8.3 kvar	9.1	J101211
4151 34	10.4 KVAr	11.4	J101211
4151 35	12.5 KVAr	13.7	J101211
4151 36	16.7 kvar	18.4	J101811
4151 37	20.8 KVAr	22.9	J102011
4151 38	25 KVAr	27.5	J103021

Note: Legrand recommends the use of INDOASIAN- CAPACITOR DUTY CONTACTORS for Legrand capacitors



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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
Kolkata : Tel.: (033) 4021 3535 / 36
Mumbai : Tel.: (022) 3385 6200
Chennai : Tel.:(044) 3024 7200, 2836 4165/67/68
Hyderabad: Tel.:(040) 2341 4398 / 67

For other places, contact the nearest
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customer.care@legrand.co.in

CB13/3000/05/2013