Power Quality

Reactive Energy Management

Low Voltage components

Catalogue

2014

Schneider Electric

Your requirements....

Optimize energy consumption

- By reducing electricity bills,
- By reducing power losses,
- By reducing CO_2 emissions.

Increase power availability

- Compensate for voltage sags detrimental to process operation,
- Avoid nuisance tripping and supply interruptions.

Improve your business performance

- Optimize installation size,
- Reduce harmonic distortion to avoid the premature ageing of equipment and destruction of sensitive components.

Our solutions....

Reactive energy management

In electrical networks, reactive energy results in increased line currents for a given active energy transmitted to loads.

The main consequences are:

- Need for oversizing of transmission and distribution networks by utilities,
- Increased voltage drops and sags along the distribution lines,
- Additional power losses.

This results in increased electricity bills for industrial customers because of:

- Penalties applied by most utilities on reactive energy,
- Increased overall kVA demand,
- Increased energy consumption within the installations.

Reactive energy management aims to optimize your electrical installation by reducing energy consumption, and to improve power availability.
Total CO_2 emissions are also reduced.

Utility power bills are typically reduced by 5 % to 10 %.

+

"Our energy con-sumption was reduced by **9 %** after we installed 10 capacitor banks with detuned reactors. Electricity bill optimised by 8 % and payback in 2 years."

Testifies Michelin Automotive in France.

"Energy consumption reduced by

5 %

with LV capacitor bank and active filter installed."

POMA OTIS Railways, Switzerland.

"70 capacitor banks with detuned reactors installed, energy consumption reduced by 10 %, electrcity bill optimised by 18 %, payback in just

1 year."

Madrid Barrajas airport Spain.

"Our network performance improved significantly after we installed 225 LV Detuned capacitor banks. The capacitor banks incorporates advanced metering system and remote communication ensures continued operation and minimal down time."

Ministry of Electricity and Water, Kuwait.

Improve electrical networks and reduce energy costs

Power Factor Correction

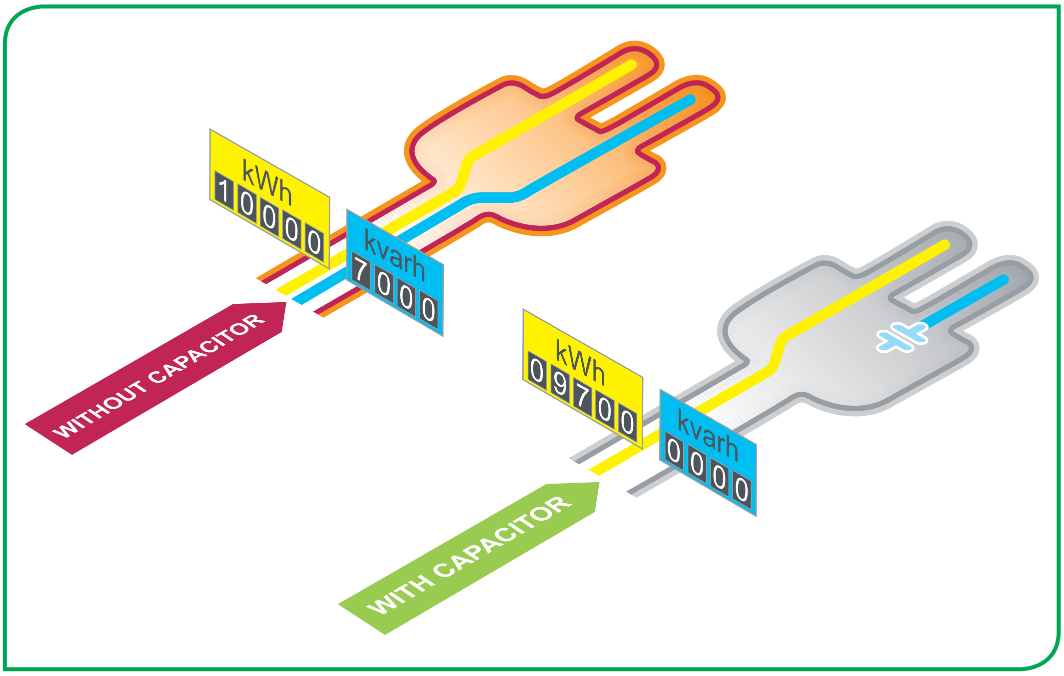
Every electric machine needs active power (kW) and reactive power (kvar) to operate. The power rating of the installation in kVA is the combination of both: $(kVA)^2 = (kW)^2 + (kvar)^2$.

The Power Factor has been defined as the ratio of active power (kW) to apparent power (kVA).

Power Factor = (kW) / (kVA).

The objective of Reactive Energy management is improvement of Power Factor, or “Power Factor Correction”.

This is typically achieved by producing reactive energy close to the consuming loads, through connection of capacitor banks to the network.



Ensure reliability and safety on installations



Quality and reliability

- Continuity of service thanks to the high performance and long life expectancy of capacitors.
- 100% testing in manufacturing plant.
- Design and engineering with the highest international standards.

Safety

- Tested safety features integrated on each phase.
- Over-pressure system for safe disconnection at the end of life.
- All materials and components are free of PCB pollutants.

Efficiency and productivity

- Product development including innovation in ergonomics and ease of installation and connection.
- Specially designed components to save time on installation and maintenance.
- All components and solutions available through a network of distributors and partners in more than 100 countries.

Thanks to the know-how developed over 50 years, Schneider Electric ranks as the global specialist in Energy management providing a unique and comprehensive portfolio.
Schneider Electric helps you to make the most of your energy with innovative, reliable and safe solutions.

Quality & Environment

Quality certified - ISO9001, ISO14001 and ISO50001

A major strength
In each of its units, Schneider Electric has an operating organization whose main role is to verify quality and ensure compliance with standards. This procedure is:
- uniform for all departments;
- recognized by numerous customers and official organizations.

But, above all, its strict application has made it possible to obtain the recognition of independent organizations.

The quality system for design and manufacturing is certified in compliance with the requirements of the ISO 9001 and ISO 14001 Quality Assurance model.

Stringent, systematic controls
During its manufacture, each equipment item undergoes systematic routine tests to verify its quality and compliance:
- measurement of operating capacity and tolerances;
- measurement of losses;
- dielectric testing;
- checks on safety and locking systems;
- checks on low-voltage components;
- verification of compliance with drawings and diagrams.

The results obtained are recorded and initialled by the Quality Control Department on the specific test certificate for each device.

RoHS, REACh Compliance
All LV PFC Components of Schneider Electric are RoHS, REACh Compliant.

BUREAU VERITAS Certification

Certification

SCHNEIDER ELECTRIC INDIA PVT. LTD.

ISO 9001:2008

22 AUGUST, 2008

30 JULY, 2014

BUREAU VERITAS Certification

SCHNEIDER ELECTRIC INDIA PVT. LTD.

ISO 14001:2004

Schneider Electric undertakes to reduce the energy bill and CO_2 emissions of its customers by proposing products, solutions and services which fit in with all levels of the energy value chain.
The Power Factor Correction and harmonic filtering offer form part of the energy efficiency approach.

A new solution for building your electrical installations

A comprehensive offer

Power Factor Correction and harmonic filtering form part of a comprehensive offer of products perfectly coordinated to meet all medium- and low-voltage power distribution needs.
Use of these products in the electrical installation will result in:
- improved continuity of service;
- reduced power losses;
- guarantee of scalability;
- efficient monitoring and management.

You thus have all the trumps in hand in terms of expertise and creativity for optimized, reliable, expandable and compliant installations.

Tools for easier design and setup

With Schneider Electric, you have a complete range of tools that support you in the knowledge and setup of products, all this in compliance with the standards in force and standard engineering practice.
These tools, technical notebooks and guides, design aid software, training courses, etc. are regularly updated.

Schneider Electric joins forces with your expertise and your creativity for optimized, reliable, expandable and compliant installations.

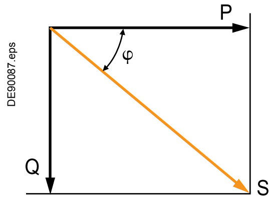
Because each electrical installation is a specific case, there is no universal solution.
The variety of combinations available allows you to achieve genuine customization of technical solutions.
You can express your creativity and highlight your expertise in the design, development and operation of an electrical installation.

General contents

Contents

Why reactive energy management?

Principle of reactive energy management



In this representation, the Power Factor (P/S) is equal to cosφ.

All AC electrical networks consume two types of power: active power (kW) and reactive power (kvar):

- **The active power P** (in kW) is the real power transmitted to loads such as motors, lamps, heaters, computers, etc. The electrical active power is transformed into mechanical power, heat or light.
- **The reactive power Q** (in kvar) is used only to power the magnetic circuits of machines, motors and transformers.

The apparent power S (in kVA) is the vector combination of active and reactive power.

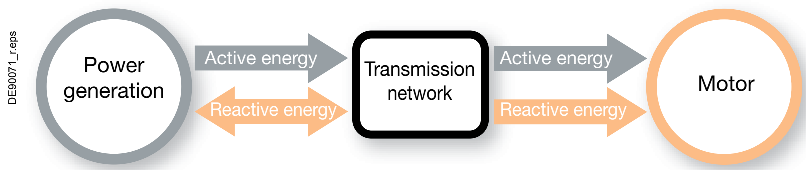
The circulation of reactive power in the electrical network has major technical and economic consequences. For the same active power P, a higher reactive power means a higher apparent power, and thus a higher current must be supplied.

The circulation of active power over time results in active energy (in kWh). The circulation of reactive power over time results in reactive energy (kvarh).

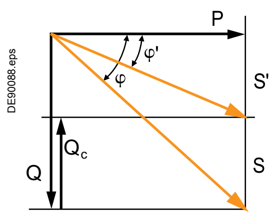
In an electrical circuit, the reactive energy is supplied in addition to the active energy.

Due to this higher supplied current, the circulation of reactive energy in distribution networks results in:

> Overload of transformers
> Higher temperature rise in power cables
> Additional losses
> Large voltage drops
> Higher energy consumption and cost
> Less distributed active power.



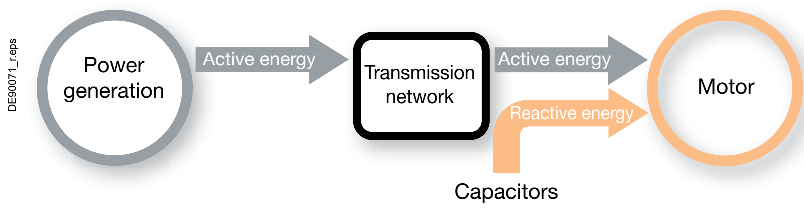
Reactive energy supplied and billed by the energy provider.



For these reasons, there is a great advantage in generating reactive energy at the load level in order to prevent the unnecessary circulation of current in the network. This is what is known as "**power factor correction**". This is obtained by the connection of capacitors, which produce reactive energy in opposition to the energy absorbed by loads such as motors.

The result is a reduced apparent power, and an improved power factor P/S' as illustrated in the diagram opposite.

The power generation and transmission networks are partially relieved, reducing power losses and making additional transmission capacity available.



The reactive power is supplied by capacitors.
No billing of reactive power by the energy supplier.

Benefits of reactive energy management

Optimized management of reactive energy brings economic and technical advantages.

Savings on the electricity bill

- Eliminating penalties on reactive energy and decreasing kVA demand.
- Reducing power losses generated in the transformers and conductors of the installation.

Example:
Loss reduction in a 630 kVA transformer PW = 6,500 W with an initial Power Factor = 0.7.
With power factor correction, we obtain a final Power Factor = 0.98.
The losses become: 3,316 W, i.e. a reduction of 49 %.

Increasing available power

A high power factor optimizes an electrical installation by allowing better use of the components. The power available at the secondary of a MV/LV transformer can therefore be increased by fitting power factor correction equipment on the low voltage side.

The table opposite shows the increased available power at the transformer output through improvement of the Power Factor from 0.7 to 1.

Power factor	Increased available power
0.7	0 %
0.8	+ 14 %
0.85	+ 21 %
0.90	+ 28 %
0.95	+ 36 %
1	+ 43 %

Reducing installation size

Installing power factor correction equipment allows conductor cross-section to be reduced, since less current is absorbed by the compensated installation for the same active power.

The opposite table shows the multiplying factor for the conductor cross-section with different power factor values.

Power factor	Cable cross-section multiplying factor
1	1
0.80	1.25
0.60	1.67
0.40	2.50

Reducing voltage drops in the installation

Installing capacitors allows voltage drops to be reduced upstream of the point where the power factor correction device is connected.
This prevents overloading of the network and reduces harmonics, so that you will not have to overrate your installation.

Method for determining compensation

The selection of Power Factor Correction equipment can follow a 4-step process:

- **Calculation of the required reactive energy.**
- **Selection of the compensation mode:**
  - Central, for the complete installation
  - By sector
  - For individual loads, such as large motors.
- **Selection of the compensation type:**
  - Fixed, by connection of a fixed-value capacitor bank;
  - Automatic, by connection of a different number of steps, allowing adjustment of the reactive energy to the required value;
  - Dynamic, for compensation of highly fluctuating loads.
- **Allowance for operating conditions and harmonics.**

Step 1: Calculation of the required reactive power

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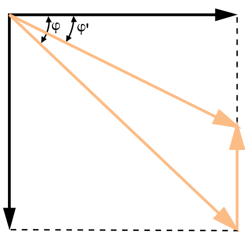


The objective is to determine the required reactive power Q_c (kvar) to be installed, in order to improve the power factor cos φ and reduce the apparent power S.

For φ' < φ, we obtain: cos φ' > cos φ and tan φ' < tan φ.

This is illustrated in the diagram opposite.

Qc can be determined from the formula Qc = P. (tan φ - tan φ'), which is deduced from the diagram.
Q_c = power of the capacitor bank in kvar.
P = active power of the load in kW.
tan φ = tangent of phase shift angle before compensation.
tan φ' = tangent of phase shift angle after compensation.

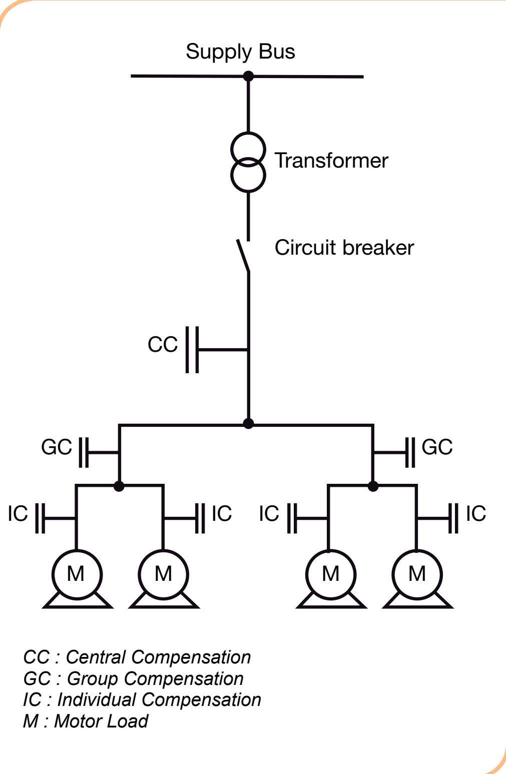
The parameters φ and tan φ can be obtained from billing data, or from direct measurement in the installation.

The following table can be used for direct determination.

Before compensation		Reactive power (kvar) to be installed per kW of load, in order to get the required cos φ' or tan φ'							
		tan φ'	0.75	0.62	0.48	0.41	0.33	0.23	0.00
		cos φ'	0.80	0.85	0.90	0.925	0.95	0.975	1.000
tan φ	cos φ								
1.73	0.5		0.98	1.11	1.25	1.32	1.40	1.50	1.73
1.02	0.70		0.27	0.40	0.54	0.61	0.69	0.79	1.02
0.96	0.72		0.21	0.34	0.48	0.55	0.64	0.74	0.96
0.91	0.74		0.16	0.29	0.42	0.50	0.58	0.68	0.91
0.86	0.76		0.11	0.24	0.37	0.44	0.53	0.63	0.86
0.80	0.78		0.05	0.18	0.32	0.39	0.47	0.57	0.80
0.75	0.80			0.13	0.27	0.34	0.42	0.52	0.75
0.70	0.82			0.08	0.21	0.29	0.37	0.47	0.70
0.65	0.84			0.03	0.16	0.24	0.32	0.42	0.65
0.59	0.86				0.11	0.18	0.26	0.37	0.59
0.54	0.88				0.06	0.13	0.21	0.31	0.54
0.48	0.90					0.07	0.16	0.26	0.48

Example: consider a 1000 kW motor with cos φ = 0.8 (tan φ = 0.75).
In order to obtain cos φ = 0.95, it is necessary to install a capacitor bank with a reactive power equal to k x P, i.e.: Qc = 0.42 x 1000 = 420 kvar.

Method for determining compensation



Step 2: Selection of the compensation mode

The location of low-voltage capacitors in an installation constitutes the mode of compensation, which may be central (one location for the entire installation), by sector (section-by-section), at load level, or some combination of the latter two. In principle, the ideal compensation is applied at a point of consumption and at the level required at any moment in time.

In practice, technical and economic factors govern the choice.

The location for connection of capacitor banks in the electrical network is determined by:

- th e overall objective (avoid penalties on reactive energy relieve transformer or cables, avoid voltage drops and sags)
- the operating mode (stable or fluctuating loads)
- the foreseeable influence of capacitors on the network characteristics
- the installation cost.

Central compensation

The capacitor bank is connected at the head of the installation to be compensated in order to provide reactive energy for the whole installation. This configuration is convenient for a stable and continuous load factor.

Group compensation (by sector)

The capacitor bank is connected at the head of the feeders supplying one particular sector to be compensated. This configuration is convenient for a large installation, with workshops having different load factors.

Compensation of individual loads

The capacitor bank is connected right at the inductive load terminals (especially large motors). This configuration is very appropriate when the load power is significant compared to the subscribed power.
This is the ideal technical configuration, as the reactive energy is produced exactly where it is needed, and adjusted to the demand.

Method for determining compensation

Step 3: Selection of the compensation type

Different types of compensation should be adopted depending on the performance requirements and complexity of control:
- Fixed, by connection of a fixed-value capacitor bank
- Automatic, by connection of a different number of steps, allowing adjustment of the reactive energy to the required value
- Dynamic, for compensation of highly fluctuating loads.

Fixed compensation

This arrangement uses one or more capacitor(s) to provide a constant level of compensation. Control may be:
- Manual: by circuit-breaker or load-break switch
- Semi-automatic: by contactor
- Direct connection to an appliance and switched with it.

These capacitors are installed:
- At the terminals of inductive loads (mainly motors)
- At busbars supplying numerous small motors and inductive appliances for which individual compensation would be too costly
- In cases where the load factor is reasonably constant.

Automatic compensation

This kind of compensation provides automatic control and adapts the quantity of reactive power to the variations of the installation in order to maintain the targeted cos φ. The equipment is installed at points in an installation where the active-power and/or reactive-power variations are relatively large, for example:
- on the busbars of a main distribution switchboard
- on the terminals of a heavily-loaded feeder cable.

Where the kvar rating of the capacitors is less than or equal to 15 % of the power supply transformer rating, a fixed value of compensation is appropriate. Above the 15 % level, it is advisable to install an automatically-controlled capacitor bank.

Control is usually provided by an electronic device (Power Factor Controller) which monitors the actual power factor and orders the connection or disconnection of capacitors in order to obtain the targeted power factor. The reactive energy is thus controlled by steps. In addition, the Power Factor Controller provides information on the network characteristics (voltage amplitude and distortion, power factor, actual active and reactive power …) and equipment status. Alarm signals are transmitted in case of malfunction.

Connection is usually provided by contactors. For compensation of highly fluctuating loads use of active filters or Electronic Var Compensators(EVC) are recommened. Contact Schneider Electric for electronic compensation solutions.

Dynamic compensation

This kind of compensation is required when fluctuating loads are present, and voltage fluctuations have to be prevented. The principle of dynamic compensation is to associate a fixed capacitor bank and an electronic var compensator, providing either leading or lagging reactive currents.

The result is continuously varying fast compensation, perfectly suitable for loads such as lifts, crushers, spot welding, etc.

Method for determining compensation

> To know more about the influence of harmonics in electrical installations, see appendix page 66

Step 4: Allowing for operating conditions and harmonics

Capacitors should be selected depending on the working conditions expected during their lifetime.

Allowing for operating conditions

The operating conditions have a great influence on the life expectancy of capacitors. The following parameters should be taken into account:

- Ambient Temperature (°C)
- Expected over-current, related to voltage disturbances, including maximum sustained overvoltage
- Maximum number of switching operations/year
- Required life expectancy.

Allowing for harmonics

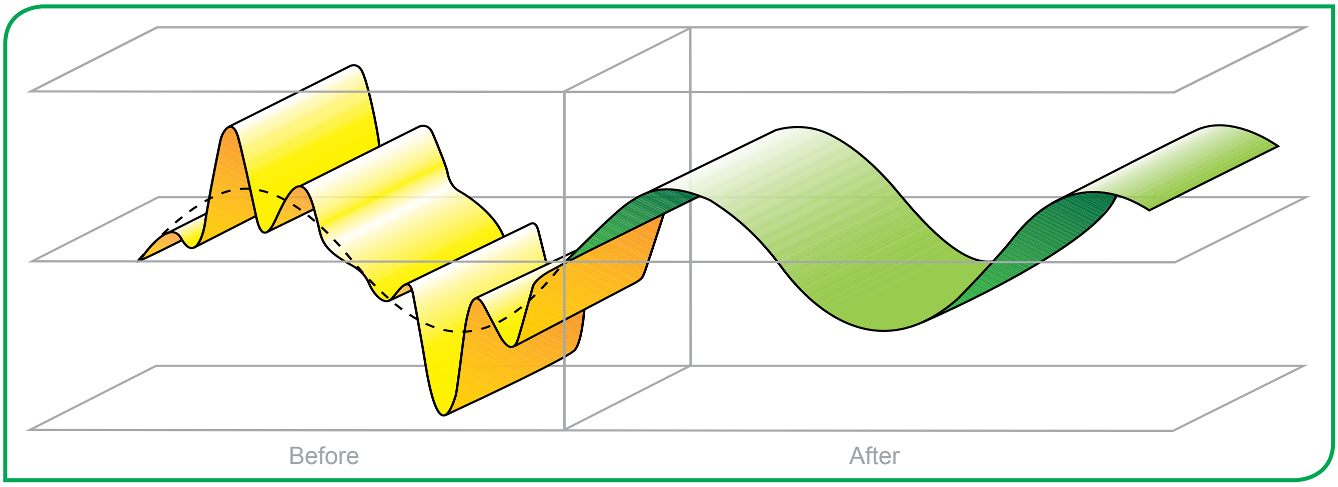
Depending on the magnitude of harmonics in the network, different configurations should be adopted.

- **Standard** capacitors: when no significant non-linear loads are present.
- **Harmonic** rated capacitors used with detuned reactors. Applicable when a significant number of non-linear loads are present. Reactors are necessary in order to prevent the amplification of harmonic currents and avoid resonance.
- **Active filters**: when non-linear loads are predominant, use of active filters are recommended for harmonic mitigation. Solutions can be recommended based on computer simulations or on site measurement of the network.

Capacitor selection

Different ranges with different levels of ruggedness are proposed:

- "**EasyCan**": Capacitors for standard operating conditions, and when no significant non-linear loads are present.
- "**VarPlus Can & Box**": Capacitors for stringent operating conditions, particularly voltage disturbances, or when a few non-linear loads are present. The rated current of capacitors must be increased in order to cope with the circulation of harmonic currents.
- "**VarPlus Box Energy**": Specially designed capacitors, for harsh operating conditions, particularly high temperature.
- **Capacitors with detuned reactors**: applicable when a significant number of non-linear loads are present.



Low Voltage capacitors with detuned reactors

Capacitors and reactors are configured in a series resonant circuit, tuned so that the series resonant frequency is below the lowest harmonic frequency present in the system

Reactors should be associated with capacitor banks for Power Factor Correction in systems with significant non-linear loads, generating harmonics. Capacitors and reactors are configured in a series resonant circuit, tuned so that the series resonant frequency is below the lowest harmonic frequency present in the system.
For this reason, this configuration is usually called “Detuned Capacitor Bank”, and the reactors are referred to as “Detuned Reactors”.

The use of detuned reactors thus prevents harmonic resonance problems, avoids the risk of overloading the capacitors and helps reduce voltage harmonic distortion in the network.

The tuning frequency can be expressed by the relative impedance of the reactor (in %), or by the tuning order, or directly in Hz.

The most common values of relative impedance are 5.7, 7 and 14 % (14 % is used with high level of 3rd harmonic voltages).

Relative impedance (%)	Tuning order	Tuning frequency @50Hz (Hz)	Tuning frequency @60Hz (Hz)
5.7	4.2	210	250
7	3.8	190	230
14	2.7	135	160

The selection of the tuning frequency of the reactor capacitor depends on several factors:
- Presence of zero-sequence harmonics (3, 9, …)
- Need for reduction of the harmonic distortion level
- Optimization of the capacitor and reactor components
- Frequency of ripple control system if any.

- To prevent disturbances of the remote control installation, the tuning frequency should be selected at a lower value than the ripple control frequency.
- In a detuned filter application, the voltage across the capacitors is higher than the system’s rated voltage. In that case, capacitors should be designed to withstand higher voltages.
- Depending on the selected tuning frequency, part of the harmonic currents is absorbed by the detuned capacitor bank. In that case, capacitors should be designed to withstand higher currents, combining fundamental and harmonic currents.

Effective reactive energy

In the pages relating to detuned capacitor banks, the reactive energy (kvar) given in the tables is the resulting reactive energy provided by the combination of capacitors and reactors.

Capacitor rated voltage

Capacitors have been specially designed to operate in detuned bank configurations. Parameters such as the rated voltage, over-voltage and over-current
capabilities have been improved, compared to standard configuration.

Rated voltage and current

According to **IEC 60681-1** standard, the **rated voltage (U_N)** of a capacitor is defined as the continuously admissible operating voltage.

The **rated current (I_N)** of a capacitor is the current flowing through the capacitor when the rated voltage (U_N) is applied at its terminals, supposing a purely sinusoidal voltage and the exact value of reactive power (kvar) generated.
Capacitor units shall be suitable for continuous operation at an r.m.s. current of (1.3 x I_N).

In order to accept system voltage fluctuations, capacitors are designed to sustain over-voltages of limited duration. For compliance to the standard, capacitors are for example requested to sustain over-voltages equal to 1.1 times U_N, 8 h per 24 h.

VarPlus Can, VarPlus Box, VarPlus Box Energy and **EasyCan** capacitors have been designed and tested extensively to operate safely on industrial networks. The design margin allows operation on networks including voltage fluctuations
and common disturbances. Capacitors can be selected with their rated voltage corresponding to the network voltage. For different levels of expected disturbances, different technologies are proposed, with larger design margin for capacitors adapted to the most stringent working conditions (VarPlus Can, VarPlus Box & VarPlus Box Energy).

VarPlus Can, VarPlus Box, VarPlus Box Energy and **EasyCan** capacitors when used along with Detuned Reactors have to be selected with a rated voltage higher than network service voltage (U_s). In detuned filter applications, the voltage across the capacitor is higher than the network service voltage (U_s).

The recommended rated voltage of capacitors to be used in detuned filter applications with respect to different network service voltage (U_s) and relative impedance is given in the table below.
These values ensure a safe operation in the most stringent operating conditions.
Less conservative values may be adopted, but a case by case analysis is necessary.

Capacitor Rated Voltage U_N (V)		Network Service Voltage U_S (V)				
		50 Hz		60 Hz		
		400	690	400	480	600
Relative Impedance (%)	5.7 7	**480**	**830**	**480**	**575**	**690**
	14	**480**		**480**		

Capacitor selection guide

Capacitors must be selected depending on the working conditions expected during their lifetime.

Solution	Description	Recommended use for	Max. condition
EasyCan	Standard capacitor	> Networks with non significant non-linear loads	$N_{LL} \leq 10$ %
		> Standard over-current	1.5 I_N
		> Standard operating temperature	55 °C (class D)
	Available in can construction	> Normal switching frequency	5,000 / year
		> Standard life expectancy	Up to 100,000h*
VarPlus Can & Box	Heavy-duty capacitor	> A few non-linear loads	$N_{LL} \leq 20$ %
		> Significant over-current	1.8 I_N
		> Standard operating temperature	55 °C (class D)
	Available in can and box construction	> Significant switching frequency	7,000 / year
		> Long life expectancy	Up to 130,000h*
VarPlus Box Energy	Capacitor for special conditions	> Significant number of non-linear loads (up to 25 %)	$N_{LL} \leq 25$ %
		> Severe over-current	2.5 I_N
		> Extreme temperature conditions	70 °C
	Available in box construction	> Very frequent switching	10,000 / year
		> Extra long life expectancy	Up to 160,000h*

** The maximum life expectancy is given considering standard operating conditions: rated voltage (U_N), rated current (I_N), 35 °C ambient temperature.*
WARNING: the life expectancy will be reduced if capacitors are used in maximum working conditions.

Since the harmonics are caused by non-linear loads, an indicator for the magnitude of harmonics is the ratio of the total power of non-linear loads to the power supply transformer rating.

This ratio is denoted N_{LL}, and is also known as G_h/S_n:
N_{LL} = Total power of non-linear loads (G_h) / Installed transformer rating (S_n).

Example:
- *Power supply transformer rating: S_n = 630 kVA*
- *Total power of non-linear loads: G_h = 150 kVA*
- *N_{LL} = (150/630) x 100 = 24 %*

It is recommended to use Detuned Reactors with Harmonic Rated Capacitors (higher rated voltage than the network service voltage - see the Harmonic Application Tables) for N_{LL} > 20 % and up to 50 %.

Note: there is a high risk in selecting the capacitors based only on N_{LL} as the harmonics in grid may cause current amplification and capacitors along with other devices may fail. Refer to page 66 for further details.

Construction of references
Principle

Capacitors

B	L	R	C	H	1 0 4 A	1 2 5 B	4 0
			Construction C = CAN B = BOX	**Range** S = EasyCan H = VarPlus E = VarPlus Energy	**Power** at 50 Hz 10.4 kvar at 50 Hz A = 50 Hz	Power at 60 Hz 12.5 kvar at 60 Hz B = 60 Hz "000B" means: labelled only for 50 Hz	**Voltage** 24 - 240 V 40 - 400 V 44 - 440 V 48 - 480 V 52 - 525 V 57 - 575 V 60 - 600 V 69 - 690 V 83 - 830 V

Example:
BLRCS200A240B44 = EasyCan, 440 V, 20 kvar at 50 Hz and 24 kvar at 60 Hz

Detuned reactors

L	V	R	0 5	1 2 5	A	6 9 T
		Detuned Reactor	Relative impedance 05 = 5.7 % 07 = 7 % 14 = 14 %	**Power** 12.5 kvar	**Freq.** A = 50 Hz B = 60 Hz	**Voltage** 40 - 400 V 48 - 480 V 60 - 600 V 69 - 690 V

Example:
LVR05125A69T = Detuned Reactor, 690 V, 5.7 %, 12.5 kvar, 50 Hz.

Contents

Offer Overview

EasyCan

Groupof3ECCaps.jpg

	EasyCan
Construction	Extruded aluminium can
Voltage range	230 V - 525 V
Power range (three-phase)	1 - 30 kvar
Peak inrush current	Up to 200 x I_N
Overvoltage	1.1 x U_N 8 h every 24 h
Overcurrent	1.5 x I_N
Mean life expectancy	Up to 100,000 h
Safety	Self-healing + 3 phase pressure-sensitive disconnector (PSD) + non accessible inbuilt discharge device (50 V/1 min)
Dielectric	Metallized Polypropylene film with Zn/Al alloy
Impregnation	Non-PCB, Biodegradable soft resin
Ambient temperature	min. -25 °C max 55 °C
Protection	IP20(for fast-on and clamptite) , indoor
Mounting	Upright
Terminals	■ Double fast-on + cable (≤ 10 kvar) ■ CLAMPTITE - Three-phase terminal with electric shock protection (finger-proof)

VarPlus Can

Group of 3 Caps.jpg

	VarPlus Can
Construction	Extruded aluminium can
Voltage range	230 V - 830 V
Power range (three-phase)	1 - 50 kvar
Peak inrush current	Up to 250 x I_N
Overvoltage	1.1 x U_N 8 h every 24 h
Overcurrent	1.8 x I_N
Mean life expectancy	Up to 130,000 h
Safety	Self-healing + 3 phase pressure-sensitive disconnector (PSD) independent of mechanical assembly+ non accessable inbuilt discharge device (50 V/1 min)
Dielectric	Metallized Polypropylene film with Zn/Al alloy with special profile metallization and wave cut
Impregnation	Non-PCB, Bio-degradable sticky resin(PU)
Ambient temperature	min. -25 °C max 55 °C
Protection	IP20(for fast-on and clamptite), indoor
Mounting	Upright, horizontal
Terminals	■ Double fast-on + cable (≤ 10 kvar) ■ CLAMPTITE - Three-phase terminal with electric shock protection (finger-proof) ■ Stud type terminal (> 30 kvar)

VarPlus Box

	VarPlus Box	VarPlus Box Energy
Construction	Steel sheet enclosure	
Voltage range	380 V - 830 V	380 V - 525 V
Power range (three-phase)	5 - 60 kvar	10 - 60 kvar
Peak inrush current	Up to 250 x I_N	Up to 350 x I_N
Overvoltage	1.1 x U_N 8 h every 24 h	
Overcurrent	1.8 x I_N	2.5 x I_N
Mean life expectancy	Up to 130,000 h	Up to 160,000 h
Safety	Self-healing + 3 phase pressure-sensitive disconnector (PSD) independent of mechanical assembly + inbuilt discharge device (50 V/1 min) + double enclosure protection (Aluminum can inside steel box)	
Dielectric	Metallized Polypropylene film with Zn/Al alloy with special profile metallization and wave cut	Double metallized paper + Polypropylene film
Impregnation	Non-PCB, sticky (dry) Biodegradable resin	Non-PCB, oil
Ambient temperature	min. -25 °C max 55 °C	min. -25 °C max 70 °C
Protection	IP20, Indoor	
Mounting	Upright	
Terminals	Bushing terminals designed for large cable termination	

EasyCan

An easy choice for savings which is optimized to deliver the performance you need. Suitable for standard operating conditions to deliver safe and reliable performance.

Group of 2 EC Caps.jpg

EasyCan

Operating conditions

- For networks with insignificant non-linear loads: (N_{LL} ≤ 10 %).
- Standard voltage disturbances.
- Standard operating temperature up to 55 °C.
- Normal switching frequency up to 5000 /year.
- Maximum current (including harmonics) is 1.5 x I_N.

Easy installation & maintenance

- Optimized design for low weight, compactness and reliability to ensure easy installation and upto 20% space savings in cubicles.
- New CLAMPTITE terminals that allows maintained tightness.
- Non accessaile in-built discharge resistors to ensure safety.
- 1 point for mounting and earthing.
- 3 phase simultaneous safe disconnection at end of life.
- Stacked design and resin filled technology for better cooling.

Safety

- Self-healing.
- Pressure-sensitive disconnector on all three phases.
- Discharge resistors fitted - non removable.
- Finger-proof CLAMPTITE terminals to reduce risk of accidental contact and to ensure firm termination (10 to 30 kvar).

Technology

Constructed internally with three single-phase capacitor elements assembled in an optimized design. Each capacitor element is manufactured with metallized polypropylene film.

The active capacitor elements are encapsulated in a specially formulated biodegradable, non-PCB, polyurethane soft resin which ensures thermal stability and heat removal from inside the capacitor.

The unique finger-proof CLAMPTITE termination is fully integrated with discharge resistors and allows suitable access to tightening and allows cable termination without any loose connections.

For lower ratings, double fast-on terminals with wires are provided.

Benefits

- Easy installation
- Easy for reliablity and safe usage.
- Easy for quality assurance.
- Easy choice for building your solutions with other Schneider Electric components.
- Easy choice for savings.

EasyCan03_Back.eps

Technical specifications

General characteristics

Standards		IEC 60831-1/2
Voltage range		230 to 525 V
Frequency		50 / 60 Hz
Power range		1 to 30 kvar
Losses (dielectric)		< 0.2 W/kvar
Losses (total)		< 0.5 W/kvar
Capacitance tolerance		-5 %, +10 %
Voltage test	Between terminals	2.15 x U_N (AC), 10 s
	Between terminal & container	3 kV (AC), 10 s or 3.66 kV (AC), 2 s
	Impulse voltage	8 kV
Discharge resistor		Fitted, standard discharge time 60 s

Working conditions

Ambient temperature	-25 / 55 °C (Class D)
Humidity	95 %
Altitude	2,000 m above sea level
Overvoltage	1.1 x U_N 8 h in every 24 h
Overcurrent	Up to 1.5 x I_N
Peak inrush current	200 x I_N
Switching operations (max.)	Up to 5,000 switching operations per year
Mean Life expectancy	Up to 100,000 hrs
Harmonic content withstand	$N_{LL} \leq 10$ %

Installation characteristics

Mounting position	Indoor, upright
Fastening	Threaded M12 stud at the bottom
Earthing	
Terminals	CLAMPTITE - three-way terminal with electric shock protection (finger-proof) & double fast-on terminal in lower kvar

Safety features

Safety	Self-healing + Pressure-sensitive disconnector + Discharge device
Protection	IP20 (for fast-on and clamptite)

Construction

Casing	Extruded Aluminium Can
Dielectric	Metallized polypropylene film with Zn/Al alloy
Impregnation	Biodegradable, Non-PCB, poly urethane soft resin

⚠ WARNING

HAZARD OF ELECTRICAL SHOCK

Wait 5 minutes after isolating supply before handling

Failure to follow these instructions can result in injury or equipment damage

Rated Voltage 240/260 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
230 V	240 V	260 V	at 260 V	230 V	240 V	260 V	at 260 V			
2.5	**2.7**	3.2	7.1	3.0	**3.3**	3.8	8.5	**46.0**	HC	**BLRCS027A033B24**
5.0	**5.4**	6.4	14.2	6.0	**6.5**	7.7	17.0	**92.1**	MC	**BLRCS054A065B24**
5.8	**6.3**	7.4	16.4	6.9	**7.5**	8.9	19.7	**116.0**	NC	**BLRCS063A075B24**
7.6	**8.3**	9.6	21.3	9.1	**10.0**	11.5	25.5	**138.1**	NC	**BLRCS083A100B24**
10.0	**10.9**	12.8	28.4	12.0	**13.0**	15.3	34.1	**152.8**	SC	**BLRCS109A130B24**

Rated Voltage 380/400/415 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
380 V	400 V	415 V	at 400 V	380 V	400 V	415 V	at 400 V			
0.9	**1.0**	1.1	1.4	1.1	**1.2**	1.3	1.7	**6.6**	EC	**BLRCS010A012B40**
1.5	**1.7**	1.8	2.5	1.8	**2.0**	2.2	2.9	**11.3**	DC	**BLRCS017A020B40**
1.8	**2.0**	2.2	2.9	2.2	**2.4**	2.6	3.5	**13.3**	DC	**BLRCS020A024B40**
2.3	**2.5**	2.7	3.6	2.7	**3.0**	3.2	4.3	**16.6**	DC	**BLRCS025A030B40**
2.7	**3.0**	3.2	4.3	3.2	**3.6**	3.9	5.2	**19.9**	DC	**BLRCS030A036B40**
3.8	**4.2**	4.5	6.1	4.5	**5.0**	5.4	7.3	**27.8**	DC	**BLRCS042A050B40**
4.5	**5.0**	5.4	7.2	5.4	**6.0**	6.5	8.7	**33.1**	HC	**BLRCS050A060B40**
5.7	**6.3**	6.8	9.1	6.8	**7.5**	8.1	10.9	**41.8**	HC	**BLRCS063A075B40**
6.8	**7.5**	8.1	10.8	8.1	**9.0**	9.7	13.0	**49.7**	HC	**BLRCS075A090B40**
7.5	**8.3**	8.9	12.0	9.0	**10.0**	10.7	14.4	**55.0**	LC	**BLRCS083A100B40**
9.4	**10.4**	11.2	15.0	11.3	**12.5**	13.4	18.0	**68.9**	MC	**BLRCS104A125B40**
11.3	**12.5**	13.5	18.0	13.5	**15.0**	16.1	21.7	**82.9**	NC	**BLRCS125A150B40**
12.5	**13.9**	15.0	20.1	15.1	**16.7**	18.0	24.1	**92.1**	NC	**BLRCS139A167B40**
13.5	**15.0**	16.1	21.7	16.2	**18.0**	19.4	26.0	**99.4**	NC	**BLRCS150A180B40**
15.1	**16.7**	18.0	24.1	18.1	**20.0**	21.6	28.9	**110.7**	SC	**BLRCS167A200B40**
18.1	**20.0**	21.5	28.9	21.7	**24.0**	25.8	34.6	**132.6**	SC	**BLRCS200A240B40**
18.8	**20.8**	22.4	30.0	22.5	**25.0**	26.9	36.0	**137.9**	SC	**BLRCS208A250B40**
20.0	**22.2**	23.9	32.0	24.0	**26.6**	28.7	38.4	**147.0**	SC	**BLRCS222A266B40**
22.6	**25.0**	26.9	36.1	27.1	**30.0**	32.3	43.3	**165.7**	SC	**BLRCS250A300B40**
25.0	**27.7**	29.8	40.0	30.0	**33.2**	35.8	48.0	**184.0**	VC	**BLRCS277A332B40**

Rated Voltage 440 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
400 V	415 V	440 V	at 440 V	400 V	415 V	440 V	at 440 V			
2.5	2.7	**3.0**	2.5	3.0	3.2	**3.6**	2.9	**16.4**	DC	**BLRCS030A036B44**
4.1	4.4	**5.0**	3.6	5.0	5.3	**6.0**	4.3	**27.4**	HC	**BLRCS050A060B44**
6.2	6.7	**7.5**	4.3	7.4	8.0	**9.0**	5.2	**41.1**	HC	**BLRCS075A090B44**
8.3	8.9	**10.0**	4.8	9.9	10.7	**12.0**	5.7	**54.8**	LC	**BLRCS100A120B44**
10.3	11.1	**12.5**	6.1	12.4	13.3	**15.0**	7.3	**68.5**	NC	**BLRCS125A150B44**
11.8	12.7	**14.3**	7.2	14.2	15.3	**17.2**	8.7	**78.3**	NC	**BLRCS143A172B44**
12.4	13.3	**15.0**	9.1	14.9	16.0	**18.0**	10.9	**82.2**	NC	**BLRCS150A180B44**
14.0	15.0	**16.9**	10.8	16.8	18.0	**20.3**	13.0	**92.6**	SC	**BLRCS169A203B44**
15.0	16.2	**18.2**	12.0	18.0	19.4	**21.8**	14.4	**99.7**	SC	**BLRCS182A218B44**
16.5	17.8	**20.0**	15.0	19.8	21.4	**24.0**	18.0	**109.6**	SC	**BLRCS200A240B44**
20.7	22.2	**25.0**	21.7	24.8	26.7	**30.0**	26.0	**137.0**	SC	**BLRCS250A300B44**
23.6	25.4	**28.5**	24.1	28.3	30.4	**34.2**	28.9	**156.1**	SC	**BLRCS285A342B44**
25.0	27.0	**30.3**	28.9	30.0	32.3	**36.4**	34.6	**166.0**	SC	**BLRCS303A364B44**

Rated Voltage 480 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
400 V	415 V	480 V	at 480 V	400 V	440 V	480 V	at 480 V			
2.9	3.1	**4.2**	5.1	3.5	4.2	**5.0**	6.1	**19.3**	DC	**BLRCS042A050B48**
4.7	5.0	**6.7**	8.1	5.6	6.8	**8.0**	9.7	**30.8**	HC	**BLRCS067A080B48**
5.1	5.5	**7.5**	8.9	6.2	7.5	**9.0**	10.7	**34.1**	HC	**BLRCS075A090B48**
6.1	6.6	**8.8**	10.6	7.3	8.9	**10.6**	12.7	**40.5**	LC	**BLRCS088A106B48**
7.2	7.8	**10.4**	12.5	8.7	10.5	**12.5**	15.0	**47.9**	MC	**BLRCS104A125B48**
8.7	9.3	**12.5**	15.0	10.4	12.6	**15.0**	18.0	**57.5**	NC	**BLRCS125A150B48**
10.0	10.8	**14.4**	17.3	12.0	14.5	**17.3**	20.8	**66.3**	NC	**BLRCS144A173B48**
10.8	11.6	**15.5**	18.6	12.9	15.6	**18.6**	22.4	**71.4**	NC	**BLRCS155A186B48**
11.8	12.7	**17.0**	20.4	14.2	17.1	**20.4**	24.5	**78.3**	NC	**BLRCS170A204B48**
12.9	13.9	**18.6**	22.4	15.5	18.8	**22.3**	26.9	**85.6**	SC	**BLRCS186A223B48**
14.4	15.5	**20.8**	25.0	17.3	21.0	**25.0**	30.0	**95.7**	SC	**BLRCS208A250B48**
17.9	19.3	**25.8**	31.0	21.5	26.0	**31.0**	37.2	**118.8**	SC	**BLRCS258A310B48**
20.0	21.5	**28.8**	34.6	24.0	29.0	**34.6**	41.6	**132.6**	VC	**BLRCS288A346B48**
21.9	23.5	**31.5**	37.9	26.3	31.8	**37.8**	45.5	**145.0**	VC	**BLRCS315A378B48**
23.5	25.3	**33.9**	40.8	28.3	34.2	**40.7**	48.9	**156.1**	XC	**BLRCS339A407B48**

Rated Voltage 525 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
415 V	480 V	525 V	at 525 V	400 V	480 V	525 V	at 525 V			
3.1	4.2	**5.0**	5.5	3.5	5.0	**6.0**	6.6	**19.2**	HC	**BLRCS050A060B52**
6.6	8.9	**10.6**	11.7	7.4	10.6	**12.7**	14.0	**40.8**	MC	**BLRCS106A127B52**
7.8	10.4	**12.5**	13.7	8.7	12.5	**15.0**	16.5	**48.1**	NC	**BLRCS125A150B52**
9.6	12.9	**15.4**	16.9	10.7	15.4	**18.5**	20.3	**59.3**	NC	**BLRCS154A185B52**
12.5	16.7	**20.0**	22.0	13.9	20.1	**24.0**	26.4	**77.0**	SC	**BLRCS200A240B52**
15.6	20.9	**25.0**	27.5	17.4	25.1	**30.0**	33.0	**96.2**	SC	**BLRCS250A300B52**

EasyCan harmonic applications

EasyCan capacitors are designed to work in slightly polluted networks with detuned reactors. 480 and 525V range of EasyCan is designed to work with detuned reactors in 400V.

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EasyCan 03.jpg

Detuned reactor *EasyCan*

Operating conditions

- For slightly polluted networks.
- Slight voltage disturbances.
- Need of switching frequency up to 5 000 /year.

Rated voltage

In a detuned filter application, the voltage across the capacitors is higher than the network service voltage (U_S). Then, capacitors must be designed to withstand higher voltages.

Depending on the selected tuning frequency, part of the harmonic currents are absorbed by the detuned capacitor bank. Then, capacitors must be designed to withstand higher currents, combining fundamental and harmonic currents.

The rated voltage of EasyCan capacitors is given in the table below, for different values of network service voltage and relative impedance.

Capacitor Rated Voltage U_N (V)		Network Service Voltage U_S (V)	
		50 Hz	60 Hz
		400	400
Relative Impedance (%)	5.7 7	**480**	**480**
	14	**480**	**480**

In the following pages, the effective power (kvar) given in the tables is the reactive power provided by the combination of capacitors and reactors.

EasyCan + Detuned Reactor + Contactor + MCCB

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+

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Network 400 V, 50 Hz   Capacitor Voltage 480 V   5.7 % / 7 % Detuned Reactor

Effective Power (kvar)	Q_N at 480 V	Capacitor Ref.	5.7% fr = 210Hz D R Ref.	7% fr = 190Hz D R Ref.	Switching: Contactor Ref.	Protection: Easypact CVS (Icu=36kA)Ref.
6.5	8.8	BLRCS088A106B48 × 1	LVR05065A40T x 1	LVR07065A40T x 1	LC1D12 × 1	LV510330 × 1
12.5	17	BLRCS170A204B48 × 1	LVR05125A40T x 1	LVR07125A40T x 1	LC1D18× 1	LV510331 × 1
25	33.9	BLRCS339A407B48 × 1	LVR05250A40T x 1	LVR07250A40T x 1	LC1D32 × 1	LV510334 × 1
50	67.9	BLRCS339A407B48 × 2	LVR05500A40T x 1	LVR07500A40T x 1	LC1D80 × 1	LV510337 × 1
100	136	BLRCS339A407B48 × 4	LVR05X00A40T x 1	LVR07X00A40T x 1	LC1D150 × 1	LV516332 × 1

Network 400 V, 50 Hz   Capacitor Voltage 480 V   14 % Detuned Reactor

Effective Power (kvar)	Q_N at 480 V	Capacitor Ref.	14% fr = 135Hz D R Ref.	Switching: Contactor Ref.	Protection: Easypact CVS (Icu=36kA)Ref.
6.5	8.8	BLRCS088A106B48 × 1	LVR14065A40T x 1	LC1D12 × 1	LV510330 × 1
12.5	15.5	BLRCS155A186B48 × 1	LVR14125A40T x 1	LC1D18× 1	LV510331 × 1
25	31.5	BLRCS315A378B48 × 1	LVR14250A40T x 1	LC1D32 × 1	LV510334 × 1
50	63	BLRCS315A378B48 × 2	LVR14500A40T x 1	LC1D80 × 1	LV510336 × 1
100	126	BLRCS315A378B48 × 4	LVR14X00A40T x 1	LC1D150 × 1	LV516333 × 1

Network 400 V, 50 Hz   Capacitor Voltage 525 V   5.7 % / 7 % Detuned Reactor

Effective Power (kvar)	Q_N at 525 V	Capacitor Ref.	5.7% fr = 210Hz D R Ref.	7% fr = 190Hz D R Ref.	Switching: Contactor Ref.	Protection: Easypact CVS (Icu=36kA) Ref.
6.5	10.6	BLRCS106A127B52 × 1	LVR05065A40T x 1	LVR07065A40T x 1	LC1D12 × 1	LV510330 × 1
12.5	20	BLRCS200A240B52 × 1	LVR05125A40T x 1	LVR07125A40T x 1	LC1D18× 1	LV510331 × 1
25	40	BLRCS200A240B52 × 2	LVR05250A40T x 1	LVR07250A40T x 1	LC1D32 × 1	LV510334 × 1
50	80	BLRCS200A240B52 x 4	LVR05500A40T x 1	LVR07500A40T x 1	LC1D80 × 1	LV510337 × 1
100	160	BLRCS200A240B52 x 8	LVR05X00A40T x 1	LVR07X00A40T x 1	LC1D150 × 1	LV516332 × 1

Network 400 V, 50 Hz   Capacitor Voltage 525 V   14 % Detuned Reactor

Effective Power (kvar)	Q_N at 525 V	Capacitor Ref.	14% fr = 135Hz D R Ref.	Switching: Contactor Ref.	Protection: Easypact CVS (Icu=36kA)Ref.
6.5	10.6	BLRCS106A127B52 × 1	LVR14065A40T x 1	LC1D12 × 1	LV510330 × 1
12.5	20	BLRCS200A240B52 x 1	LVR14125A40T x 1	LC1D18× 1	LV510331 × 1
25	40	BLRCS200A240B52 x 2	LVR14250A40T x 1	LC1D32 × 1	LV510334 × 1
50	75	BLRCS250A300B52 × 3	LVR14500A40T x 1	LC1D80 × 1	LV510336 × 1
100	150	BLRCS250A300B52 × 6	LVR14X00A40T x 1	LC1D150 × 1	LV516333 × 1

EasyCan + Detuned Reactor + Contactor + MCCB

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EasyCan 04.jpg

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Network 400 V, 60 Hz Capacitor Voltage 480 V 5.7 % / 7 % Detuned Reactor

Effective Power (kvar)	Q_N at 480 V	Capacitor Ref.	5.7% fr = 250Hz D R Ref.	7% fr = 230Hz D R Ref.	Switching: Contactor Ref.	Protection: Easypact CVS (Icu=36kA)Ref.
12.5	17.3	BLRCS144A173B48 × 1	LVR05125B40T × 1	LVR07125B40T × 1	LC1D18× 1	LV510331 × 1
25	34.6	BLRCS288A346B48 × 1	LVR05250B40T × 1	LVR07250B40T × 1	LC1D32 × 1	LV510334 × 1
50	69.2	BLRCS288A346B48 × 2	LVR05500B40T × 1	LVR07500B40T × 1	LC1D80 × 1	LV510337 × 1
100	138.4	BLRCS288A346B48 × 4	LVR05X00B40T × 1	LVR07X00B40T × 1	LC1D150 × 1	LV516332 × 1

Network 400 V, 60 Hz Capacitor Voltage 480 V 14 % Detuned Reactor

Effective Power (kvar)	Q_N at 480 V	Capacitor Ref.	14% fr = 160Hz D R Ref.	Switching: Contactor Ref.	Protection: Easypact CVS (Icu=36kA)Ref.
12.5	16.3	BLRCS136A163B48 × 1	LVR14125B40T × 1	LC1D18× 1	LV510331 × 1
25	31	BLRCS258A310B48 × 1	LVR14250B40T × 1	LC1D32 × 1	LV510334 × 1
50	62	BLRCS258A310B48 × 2	LVR14500B40T × 1	LC1D80 × 1	LV510336 × 1
100	124	BLRCS258A310B48 × 4	LVR14X00B40T × 1	LC1D150 × 1	LV516333 × 1

VarPlus Can

A safe, reliable, high-performance and flexible solution for power factor correction in stringent operating conditions to maximise your savings

Group of 3 Caps.jpg

VarPlus Can

Operating conditions

- For networks with insignificant non-linear loads: (N_{LL} < 20 %).
- Significant voltage disturbances.
- Standard operating temperature up to 55 °C.
- Normal switching frequency up to 7 000 /year.
- Over current handling(including harmonics) up to 1.8 x I_N.

High performance and flexibility with VarPlus Can

- Power ratings up to 50kvar in single can and compactness across the range to reduce your cubicle space up to 40%.
- Build your type tested Schneider electric solution with VarPlus Can – Prisma, Blokset and Okken.
- In-built user assistance and warnings on the product for a delight user experience.
- Flexibility in Vertical and horizontal mounting.
- 3 Phase disconnection of Pressure sensitive disconnector at the end of life which is independent of mechanical assembly for safety and reliability.
- Use of special conductors in stacked design impregnated in resin to ensure better cooling and enhanced life.
- Metallized polypropylene with wave cut and heavy edge technology to handle over current conditions in harsh environments.
- Specially formulated sticky resin to increase the mechanical stability of capacitor elements for higher rating capacitors to ensure better cooling and extended life.
- Designed for high performance in harsh environment to ensure 30% extended life compared to standard capacitors.

Safety

- Self-healing.
- Pressure-sensitive disconnector on all three phases independent of mechanical assembly.
- Tamper resistant non-assessible in-built discharge resistors.
- Unique Finger-proof New CLAMPTITE terminals to reduce risk of accidental contact and to ensure firm termination (10 to 30 kvar) and maintained tightness.
- Special film resistivity and metallization profile for higher thermal efficiency, lower temperature rise and enhanced life expectancy.

Technology

VarPlus Can capacitors are constructed internally with three single-phase capacitor elements. Each capacitor element is manufactured with metallized polypropylene film as the dielectric, having features such as heavy edge, slope metallization and wave-cut profile to ensure increased current handling capacity and reduced temperature rise.

Sticky resign which give good thermal conductivity and mechanical stability allows the capacitor to carry higher overloads.

Stud type terminals are designed for handling higher currents for capacitors more than 30kvar.

The unique finger-proof CLAMPTITE termination is fully integrated with discharge resistors, allowing suitable access for tightening and ensuring cable termination without any loose connections.

For lower ratings, double fast-on terminals with wires are provided.

Benefits

- Save panel space due to its compact design and range.
- High Performance & Long life.
- High over current handling.
- Unique disconnection system and in-built discharge device.
- Flexibility in installation - upright and horizontal.

VarPlus Can

Technical specifications

General characteristics

Standards		IEC 60831-1/2
Voltage range		230 to 830 V
Frequency		50 / 60 Hz
Power range		1 to 50 kvar
Losses (dielectric)		< 0.2 W / kvar
Losses (total)		< 0.5 W / kvar
Capacitance tolerance		-5 %, +10 %
Voltage test	Between terminals	2.15 x U_N (AC), 10 s
	Between terminal & container	≤ 525 V: 3 kV (AC), 10 s or 3.66 kV (AC), 2 s > 525 V: 3.66 kV (AC), 10 s or 4.4 kV (AC), 2 s
	Impulse voltage	≤ 690 V: 8 kV > 690 V: 12 kV
Discharge resistor		Fitted, standard discharge time 60 s

Working conditions

Ambient temperature	-25 / 55 °C (Class D)
Humidity	95 %
Altitude	2,000 m above sea level
Overvoltage	1.1 x U_N 8 h in every 24 h
Overcurrent	Up to 1.8 x I_N
Peak inrush current	250 x I_N
Switching operations (max.)	Up to 7,000 switching operations per year
Mean Life expectancy	Up to 130,000 hrs
Harmonic content withstand	N_{LL} ≤ 20 %

Installation characteristics

Mounting position	Indoor, upright & horizontal
Fastening	Threaded M12 stud at the bottom
Earthing	
Terminals	CLAMPTITE - three-way terminal with electric shock protection (finger-proof) and, double fast-on terminal in lower kvar and stud type above 30kvar

Safety features

Safety	Self-healing + Pressure-sensitive disconnector + Discharge device
Protection	IP20 (for fast-on and clamptite terminal)

Construction

Casing	Extruded Aluminium Can
Dielectric	Metallized polypropylene film with Zn/Al alloy. Special resistivity & profile, special edge (wave-cut)
Impregnation	Non-PCB, polyurethene sticky resin (Dry)

⚠ WARNING

HAZARD OF ELECTRICAL SHOCK

Wait 5 minutes after isolating supply before handling

Failure to follow these instructions can result in injury or equipment damage

VarPlus Can

Rated Voltage 240/260 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
230 V	240 V	260 V	at 260 V	230 V	240 V	260 V	at 260 V			
1.9	**2.1**	2.5	5.5	2.3	**2.5**	3.0	6.6	**38.7**	HC	**BLRCH021A025B24**
2.5	**2.7**	3.2	7.0	3.0	**3.3**	3.8	8.4	**49.7**	HC	**BLRCH027A033B24**
3.9	**4.2**	4.9	10.9	4.6	**5.0**	5.9	13.1	**77.3**	HC	**BLRCH042A050B24**
5.0	**5.4**	6.3	14.1	6.0	**6.5**	7.6	16.9	**99.4**	MC	**BLRCH054A065B24**
5.8	**6.3**	7.4	16.4	6.9	**7.5**	8.8	19.5	**116.0**	RC	**BLRCH063A075B24**
7.6	**8.3**	9.7	21.6	9.2	**10.0**	11.7	26.1	**152.4**	RC	**BLRCH083A100B24**
10.0	**10.9**	12.8	28.4	12.0	**13.0**	15.3	34.1	**200.5**	TC	**BLRCH109A130B24**
10.7	**11.7**	13.7	30.4	12.9	**14.0**	16.4	36.5	**214.8**	TC	**BLRCH117A140B24**
12.0	**13.1**	15.4	34.1	14.4	**15.7**	18.4	40.9	**240.9**	TC	**BLRCH131A157B24**

Rated Voltage 380/400/415 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
380 V	400 V	415 V	at 400 V	380 V	400 V	415 V	at 400 V			
2.3	**2.5**	2.7	3.6	2.7	**3.0**	3.2	4.3	**16.6**	DC	**BLRCH025A030B40**
2.7	**3.0**	3.2	4.3	3.2	**3.6**	3.9	5.2	**19.9**	DC	**BLRCH030A036B40**
4.5	**5.0**	5.4	7.2	5.4	**6.0**	6.5	8.7	**33.1**	HC	**BLRCH050A060B40**
5.7	**6.3**	6.8	9.1	6.8	**7.5**	8.1	10.8	**41.8**	HC	**BLRCH063A075B40**
6.8	**7.5**	8.1	10.8	8.1	**9.0**	9.7	13.0	**49.7**	HC	**BLRCH075A090B40**
7.5	**8.3**	8.9	12.0	9.0	**10.0**	10.7	14.4	**55.0**	LC	**BLRCH083A100B40**
9.4	**10.4**	11.2	15.0	11.3	**12.5**	13.4	18.0	**68.9**	MC	**BLRCH104A125B40**
11.3	**12.5**	13.5	18.0	13.5	**15.0**	16.1	21.7	**82.9**	RC	**BLRCH125A150B40**
13.5	**15.0**	16.1	21.7	16.2	**18.0**	19.4	26.0	**99.4**	RC	**BLRCH150A180B40**
15.1	**16.7**	18.0	24.1	18.1	**20.0**	21.6	28.9	**110.7**	TC	**BLRCH167A200B40**
18.1	**20.0**	21.5	28.9	21.7	**24.0**	25.8	34.6	**132.6**	TC	**BLRCH200A240B40**
18.8	**20.8**	22.4	30.0	22.5	**25.0**	26.9	36.0	**137.9**	TC	**BLRCH208A250B40**
22.6	**25.0**	26.9	36.1	27.1	**30.0**	32.3	43.3	**165.7**	TC	**BLRCH250A300B40**
27.1	**30.0**	32.3	43.3	32.5	**36.0**	38.8	52.0	**198.9**	VC	**BLRCH300A360B40**
30.1	**33.3**	35.8	48.1	36.1	**40.0**	43.0	57.7	**220.7**	VC	**BLRCH333A400B40**
36.1	**40.0**	43.1	57.7	43.3	**48.0**	51.7	69.3	**265.2**	YC	**BLRCH400A480B40**
37.6	**41.7**	44.9	60.2	45.2	**50.0**	53.9	72.2	**276.4**	YC	**BLRCH417A500B40**
45.1	**50.0**	53.8	72.2	---	**---**	---	---	**331.4**	YC	**BLRCH500A000B40**

Rated Voltage 440 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
400 V	415 V	440 V	at 440 V	400 V	415 V	440 V	at 440 V			
4.1	4.4	**5.0**	6.6	5.0	5.3	**6.0**	7.9	**27.4**	HC	**BLRCH050A060B44**
6.2	6.7	**7.5**	9.8	7.4	8.0	**9.0**	11.8	**41.1**	HC	**BLRCH075A090B44**
8.3	8.9	**10.0**	13.1	9.9	10.7	**12.0**	15.7	**54.8**	MC	**BLRCH100A120B44**
10.3	11.1	**12.5**	16.4	12.4	13.3	**15.0**	19.7	**68.5**	RC	**BLRCH125A150B44**
11.8	12.7	**14.3**	18.8	14.2	15.3	**17.2**	22.5	**78.3**	RC	**BLRCH143A172B44**
12.4	13.3	**15.0**	19.7	14.9	16.0	**18.0**	23.6	**82.2**	RC	**BLRCH150A180B44**
14.0	15.0	**16.9**	22.2	16.8	18.0	**20.3**	26.6	**92.6**	TC	**BLRCH169A203B44**
15.0	16.2	**18.2**	23.9	18.0	19.4	**21.8**	28.7	**99.7**	TC	**BLRCH182A218B44**
16.5	17.8	**20.0**	26.2	19.8	21.4	**24.0**	31.5	**109.6**	TC	**BLRCH200A240B44**
20.7	22.2	**25.0**	32.8	24.8	26.7	**30.0**	39.4	**137.0**	TC	**BLRCH250A300B44**
23.6	25.4	**28.5**	37.4	28.3	30.4	**34.2**	44.9	**156.1**	VC	**BLRCH285A342B44**
25.0	27.0	**30.3**	39.8	---	---	**---**	---	**166.0**	VC	**BLRCH303A000B44**
26.0	28.0	**31.5**	41.3	31.2	33.6	**37.8**	49.6	**172.6**	VC	**BLRCH315A378B44**
27.7	29.8	**33.5**	44.0	33.2	35.8	**40.1**	52.7	**183.5**	VC	**BLRCH335A401B44**
33.1	35.6	**40.0**	52.5	39.7	42.7	**48.0**	63.0	**219.1**	XC	**BLRCH400A480B44**
41.3	44.5	**50.0**	65.6	49.6	53.4	**---**	---	**273.9**	YC	**BLRCH500A000B44**
47.2	50.8	**57.1**	74.9	56.6	61.0	**---**	---	**312.8**	YC	**BLRCH571A000B44**

Rated Voltage 480 V

50 Hz				60 Hz				μF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
400 V	415 V	480 V	at 480 V	400 V	440 V	480 V	at 480 V			
2.9	3.1	**4.2**	5.1	3.5	4.2	**5.0**	6.1	**19.3**	DC	**BLRCH042A050B48**
3.5	3.7	**5.0**	6.0	4.2	5.0	**6.0**	7.2	**23.0**	HC	**BLRCH050A060B48**
5.2	5.6	**7.5**	9.0	6.3	7.6	**9.0**	10.8	**34.5**	HC	**BLRCH075A090B48**
6.1	6.6	**8.8**	10.6	7.3	8.9	**10.6**	12.7	**40.5**	LC	**BLRCH088A106B48**
7.2	7.8	**10.4**	12.5	8.7	10.5	**12.5**	15.0	**47.9**	MC	**BLRCH104A125B48**
7.8	8.4	**11.3**	13.6	9.4	11.4	**13.6**	16.3	**52.0**	MC	**BLRCH113A136B48**
8.7	9.3	**12.5**	15.0	10.4	12.6	**15.0**	18.0	**57.5**	RC	**BLRCH125A150B48**
9.4	10.2	**13.6**	16.4	11.3	13.7	**16.3**	19.6	**62.6**	RC	**BLRCH136A163B48**
10.0	10.8	**14.4**	17.3	12.0	14.5	**17.3**	20.8	**66.3**	RC	**BLRCH144A173B48**
10.8	11.6	**15.5**	18.6	12.9	15.6	**18.6**	22.4	**71.4**	RC	**BLRCH155A186B48**
11.8	12.7	**17.0**	20.4	14.2	17.1	**20.4**	24.5	**78.3**	RC	**BLRCH170A204B48**
12.5	13.5	**18.0**	21.7	15.0	18.2	**21.6**	26.0	**82.9**	TC	**BLRCH180A216B48**
13.3	14.4	**19.2**	23.1	16.0	19.4	**23.0**	27.7	**88.4**	TC	**BLRCH192A230B48**
14.4	15.5	**20.8**	25.0	17.3	21.0	**25.0**	30.0	**95.7**	TC	**BLRCH208A250B48**
15.8	17.0	**22.7**	27.3	18.9	22.9	**27.2**	32.8	**104.5**	TC	**BLRCH227A272B48**
17.9	19.3	**25.8**	31.0	21.5	26.0	**31.0**	37.2	**118.8**	TC	**BLRCH258A310B48**
20.0	21.5	**28.8**	34.6	24.0	29.0	**34.6**	41.6	**132.6**	VC	**BLRCH288A346B48**
21.9	23.5	**31.5**	37.9	26.3	31.8	**37.8**	45.5	**145.0**	VC	**BLRCH315A378B48**
23.5	25.3	**33.9**	40.8	28.3	34.2	**40.7**	48.9	**156.1**	XC	**BLRCH339A407B48**

Rated Voltage 525 V

50 Hz				60 Hz				μF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
415 V	480 V	525 V	at 525 V	400 V	480 V	525 V	at 525 V			
3.1	4.2	**5.0**	5.5	3.5	5.0	**6.0**	6.6	**19.2**	HC	**BLRCH050A060B52**
6.2	8.4	**10.0**	11.0	7.0	10.0	**12.0**	13.2	**38.5**	LC	**BLRCH100A120B52**
6.6	8.9	**10.6**	11.7	7.4	10.6	**12.7**	14.0	**40.8**	MC	**BLRCH106A127B52**
7.8	10.4	**12.5**	13.7	8.7	12.5	**15.0**	16.5	**48.1**	RC	**BLRCH125A150B52**
9.4	12.5	**15.0**	16.5	10.4	15.0	**18.0**	19.8	**57.7**	RC	**BLRCH150A180B52**
10.7	14.4	**17.2**	18.9	12.0	17.3	**20.6**	22.7	**66.2**	RC	**BLRCH172A206B52**
11.6	15.5	**18.5**	20.3	12.9	18.6	**22.2**	24.4	**71.2**	TC	**BLRCH185A222B52**
12.5	16.7	**20.0**	22.0	13.9	20.1	**24.0**	26.4	**77.0**	TC	**BLRCH200A240B52**
15.6	20.9	**25.0**	27.5	17.4	25.1	**30.0**	33.0	**96.2**	TC	**BLRCH250A300B52**
19.3	25.8	**30.9**	34.0	21.5	31.0	**37.1**	40.8	**118.9**	VC	**BLRCH309A371B52**
21.5	28.8	**34.4**	37.8	24.0	34.5	**41.3**	45.4	**132.4**	VC	**BLRCH344A413B52**
23.6	31.5	**37.7**	41.5	26.3	37.8	**45.2**	49.8	**145.1**	VC	**BLRCH377A452B52**
25.0	33.4	**40.0**	44.0	27.9	40.1	**48.0**	52.8	**153.9**	XC	**BLRCH400A480B52**

Rated Voltage 575 V

50 Hz				60 Hz				μF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
480 V	550 V	575 V	at 575 V	480 V	550 V	575 V	at 575 V			
8.4	11.0	**12.0**	12.0	9.3	13.2	**14.4**	14.5	**38.5**	RC	**BLRCH120A144B57**
10.5	13.7	**15.0**	15.1	11.7	16.5	**18.0**	18.1	**48.1**	TC	**BLRCH150A180B57**
20.3	26.7	**29.2**	29.3	22.7	32.0	**35.0**	35.1	**93.6**	VC	**BLRCH292A350B57**

VarPlus Can

Rated Voltage 600 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
480 V	550 V	600 V	at 600 V	480 V	550 V	600 V	at 600 V			
5.3	7.0	**8.3**	8.8	6.4	8.4	**10.0**	9.6	**24.5**	RC	**BLRCH083A100B60**
6.7	8.7	**10.4**	11.0	8.0	10.5	**12.5**	12.0	**30.6**	TC	**BLRCH104A125B60**
8.0	10.5	**12.5**	11.7	9.6	12.6	**15.0**	14.4	**36.8**	TC	**BLRCH125A150B60**
13.3	17.5	**20.8**	14.8	16.0	21.0	**25.0**	24.0	**61.3**	VC	**BLRCH208A250B60**
16.0	21.0	**25.0**	17.8	19.2	25.2	**30.0**	28.9	**221.1** #	YC	**BLRCH250A300B60** #
26.7	35.0	**41.7**	18.9	32.0	42.0	**50.0**	48.2	**368.9** #	YC	**BLRCH417A500B60** #

Rated Voltage 690 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
480 V	600 V	690 V	at 690 V	480 V	600 V	690 V	at 690 V			
5.4	8.4	**11.1**	9.3	6.4	10.1	**13.3**	11.1	**24.7**	RC	**BLRCH111A133B69**
6.0	9.5	**12.5**	10.5	7.3	11.3	**15.0**	12.6	**27.8**	RC	**BLRCH125A150B69**
6.7	10.4	**13.8**	11.5	8.0	12.5	**16.5**	13.8	**30.6**	TC	**BLRCH138A165B69**
7.3	11.3	**15.0**	12.6	8.7	13.6	**18.0**	15.1	**33.4**	TC	**BLRCH150A180B69**
9.7	15.1	**20.0**	16.7	11.6	18.1	**24.0**	20.1	**44.6**	TC	**BLRCH200A240B69**
12.1	18.9	**25.0**	20.9	14.5	22.7	**30.0**	25.1	**55.7**	VC	**BLRCH250A300B69**
13.3	20.9	**27.6**	23.1	16.0	25.0	**33.1**	27.7	**61.4**	VC	**BLRCH276A331B69**
14.5	22.7	**30.0**	25.1	17.4	27.2	**36.0**	30.1	**66.8**	VC	**BLRCH300A360B69**
19.4	30.2	**40.0**	33.5	23.2	36.3	**48.0**	40.2	**267.6** #	YC	**BLRCH400A480B69** #
25.2	39.3	**52.0**	43.5	30.2	47.2	**62.4**	52.2	**347.8** #	YC	**BLRCH520A624B69** #

Rated Voltage 830 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
600 V	690 V	830 V	at 830 V	600 V	690 V	830 V	at 830 V			
8.9	11.8	**17.1**	11.9	10.7	14.2	**20.5**	14.3	**79.2** #	VC	**BLRCH171A205B83** #

Available in star connection.

VarPlus Can harmonic applications

VarPlus Can capacitors are designed for applications where higher number of non-linear loads are present. Higher current carrying capacity in VarPlus Can allows the operations in stringent conditions.

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VarPlus Can 04.jpg

Detuned reactor *VarPlus Can*

Operating conditions

- For networks with a large number of non-linear loads (N_{LL} < 50 %).
- Significant voltage disturbances.
- Significant switching frequency up to 7 000 /year.

Rated voltage

In a detuned filter application, the voltage across the capacitors is higher than the network service voltage (U_S). Then, capacitors must be designed to withstand higher voltages.

Depending on the selected tuning frequency, part of the harmonic currents are absorbed by the detuned capacitor bank. Then, capacitors must be designed to withstand higher currents, combining fundamental and harmonic currents.

The rated voltage of VarPlus Can capacitors is given in the table below, for different values of network service voltage and relative impedance.

Capacitor Rated Voltage U_N (V)		**Network Service Voltage U_S (V)**				
		50 Hz		**60 Hz**		
		400	**690**	**400**	**480**	**600**
Relative Impedance (%)	5.7 / 7	**480**	**830**	**480**	**575**	**690**
	14	**480**	**-**	**480**	**-**	**-**

In the following pages, the effective power (kvar) given in the tables is the reactive power provided by the combination of capacitors and reactors.

VarPlus Can + Detuned Reactor + Contactor + MCCB

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+

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+

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+

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Network 400 V, 50 Hz Capacitor Voltage 480 V 5.7 % / 7 % Detuned Reactor

Effective Power (kvar)	Q_N at 480 V	Capacitor Ref.	5.7% fr = 210Hz D R Ref.	7% fr = 190Hz D R Ref.	Switching: Contactor Ref.	Protection: Compact NSX (Icu=50kA) Ref.
6.5	8.8	BLRCH088A106B48 × 1	LVR05065A40T x 1	LVR07065A40T x 1	LC1D12 × 1	LV429847 × 1
12.5	17	BLRCH170A204B48 × 1	LVR05125A40T x 1	LVR07125A40T x 1	LC1D18× 1	LV429846 × 1
25	33.9	BLRCH339A407B48 × 1	LVR05250A40T x 1	LVR07250A40T x 1	LC1D32 × 1	LV429843 × 1
50	67.9	BLRCH339A407B48 × 2	LVR05500A40T x 1	LVR07500A40T x 1	LC1D80 × 1	LV429840 × 1
100	136	BLRCH339A407B48 × 4	LVR05X00A40T x 1	LVR07X00A40T x 1	LC1D150 × 1	LV431831 × 1

Network 400 V, 50 Hz Capacitor Voltage 480 V 14 % Detuned Reactor

Effective Power (kvar)	Q_N at 480 V	Capacitor Ref.	14% fr = 135Hz D R Ref.	Switching: Contactor Ref.	Protection: Compact NSX (Icu=50kA) Ref.
6.5	8.8	BLRCH088A106B48 × 1	LVR14065A40T x 1	LC1D12 × 1	LV429847 × 1
12.5	15.5	BLRCH155A186B48 × 1	LVR14125A40T x 1	LC1D18× 1	LV429846 × 1
25	31.5	BLRCH315A378B48 × 1	LVR14250A40T x 1	LC1D32 × 1	LV429844 × 1
50	63	BLRCH315A378B48 × 2	LVR14500A40T x 1	LC1D80 × 1	LV429841 × 1
100	126	BLRCH315A378B48 × 4	LVR14X00A40T x 1	LC1D150 × 1	LV430840× 1

Network 400 V, 50 Hz Capacitor Voltage 525 V 5.7 % / 7 % Detuned Reactor

Effective Power (kvar)	Q_N at 525 V	Capacitor Ref.	5.7% fr = 210Hz D R Ref.	7% fr = 190Hz D R Ref.	Switching: Contactor Ref.	Protection: Compact NSX (Icu=50kA) Ref.
6.5	10.6	BLRCH106A127B52 × 1	LVR05065A40T x 1	LVR07065A40T x 1	LC1D12 × 1	LV429847 × 1
12.5	20	BLRCH200A240B52 × 1	LVR05125A40T x 1	LVR07125A40T x 1	LC1D18× 1	LV429846 × 1
25	40	BLRCH400A480B52 × 1	LVR05250A40T x 1	LVR07250A40T x 1	LC1D32 × 1	LV429843 × 1
50	80	BLRCH400A480B52 × 2	LVR05500A40T x 1	LVR07500A40T x 1	LC1D80 × 1	LV429840 × 1
100	160	BLRCH400A480B52 × 4	LVR05X00A40T x 1	LVR07X00A40T x 1	LC1D150 × 1	LV431831 × 1

Network 400 V, 50 Hz Capacitor Voltage 525 V 14 % Detuned Reactor

Effective Power (kvar)	Q_N at 525 V	Capacitor Ref.	14% fr = 135Hz D R Ref.	Switching: Contactor Ref.	Protection: Compact NSX (Icu=50kA) Ref.
6.5	10.6	BLRCH106A127B52 × 1	LVR14065A40T x 1	LC1D12 × 1	LV429847 × 1
12.5	18.5	BLRCH185A222B52 × 1	LVR14125A40T x 1	LC1D18× 1	LV429846 × 1
25	37.7	BLRCH377A452B52 × 1	LVR14250A40T x 1	LC1D32 × 1	LV429844 × 1
50	75	BLRCH377A452B52 × 2	LVR14500A40T x 1	LC1D80 × 1	LV429841 × 1
100	150	BLRCH377A452B52 × 4	LVR14X00A40T x 1	LC1D150 × 1	LV430840 × 1

Network 690 V, 50 Hz Capacitor Voltage 830 V 5.7 % / 7 % Detuned Reactor

Effective Power (kvar)	Q_N at 830 V	Capacitor Ref.	5.7% fr = 210Hz D R Ref.	7% fr = 190Hz D R Ref.	Switching: Contactor Ref.	Protection: Compact NSX (Icu=10kA) Ref.
12.5	17.1	BLRCH171A205B83 × 1	LVR05125A69T × 1	LVR07125A69T × 1	LC1D12 × 1	LV429847 × 1
25	34.2	BLRCH171A205B83 × 2	LVR05250A69T × 1	LVR07250A69T × 1	LC1D25 × 1	LV429845 × 1
50	68.4	BLRCH171A205B83 × 4	LVR05500A69T × 1	LVR07500A69T × 1	LC1D50 × 1	LV429842 × 1
100	136.8	BLRCH171A205B83 × 8	LVR05X00A69T × 1	LVR07X00A69T × 1	LC1D80 × 1	LV430841 × 1

VarPlus Can + Detuned Reactor + Contactor + MCCB

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VarPlus Can 02.jpg

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Network 400 V, 60 Hz Capacitor Voltage 480 V 5.7 % / 7 % Detuned Reactor

Effective Power (kvar)	Q_N at 480 V	Capacitor Ref.	5.7% fr = 250Hz D R Ref.	7% fr = 230Hz D R Ref.	Switching: Contactor Ref.	Protection: Compact NSX (I_{cu}=50kA) Ref.
12.5	17.3	BLRCH144A173B48 × 1	LVR05125B40T × 1	LVR07125B40T × 1	LC1D12 × 1	LV429846 × 1
25	34.6	BLRCH288A346B48 × 1	LVR05250B40T × 1	LVR07250B40T × 1	LC1D32 × 1	LV429843 × 1
50	67.9	BLRCH288A346B48 × 2	LVR05500B40T × 1	LVR07500B40T × 1	LC1D80 × 1	LV429840 × 1
100	135.8	BLRCH288A346B48 × 4	LVR05X00B40T × 1	LVR07X00B40T × 1	LC1D150 × 1	LV431831 × 1

Network 400 V, 60 Hz Capacitor Voltage 480 V 14 % Detuned Reactor

Effective Power (kvar)	Q_N at 480 V	Capacitor Ref.	14% fr = 160Hz D R Ref.	Switching: Contactor Ref.	Protection: Compact NSX (I_{cu}=50kA) Ref.
12.5	16.3	BLRCH136A163B48 × 1	LVR14125B40T × 1	LC1D18× 1	LV429846 × 1
25	31	BLRCH258A310B48 × 1	LVR14250B40T × 1	LC1D25 × 1	LV429844 × 1
50	62	BLRCH258A310B48 × 2	LVR14500B40T × 1	LC1D50 × 1	LV429841 × 1
100	124	BLRCH258A310B48 × 4	LVR14X00B40T × 1	LC1D150 × 1	LV430840× 1

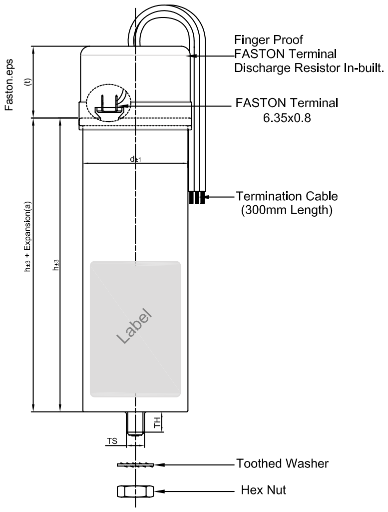
Network 480 V, 60 Hz Capacitor Voltage 575 V 5.7 % Detuned Reactor

Effective Power (kvar)	Q_N at 575 V	Capacitor Ref.	5.7% fr = 250Hz D R Ref.	Switching: Contactor Ref.	Protection: Compact NSX (I_{cu}=50kA) Ref.
12.5	18	BLRCH150A180B57 × 1	LVR05125B48T × 1	LC1D12 × 1	LV429846 × 1
25	35	BLRCH292A350B57 × 1	LVR05250B48T × 1	LC1D25 × 1	LV429844 × 1
50	70	BLRCH292A350B57 × 2	LVR05500B48T × 1	LC1D50 × 1	LV429841 × 1
100	140	BLRCH292A350B57 × 4	LVR05X00B48T × 1	LC1D115 × 1	LV430840 × 1

Network 600 V, 60 Hz Capacitor Voltage 690 V 5.7 % Detuned Reactor

Effective Power (kvar)	Q_N at 690 V	Capacitor Ref.	5.7% fr = 250Hz R Ref.	Switching: Contactor Ref.	Protection: Compact NSX (I_{cu}=20kA) Ref.
12.5	16.5	BLRCH138A165B69 × 1	LVR05125B60T × 1	LC1D12 × 1	LV429847 × 1
25	33.1	BLRCH276A331B69 × 1	LVR05250B60T × 1	LC1D25 × 1	LV429845 × 1
50	66.2	BLRCH520A624B69 × 1	LVR05500B60T × 1	LC1D50 × 1	LV429842 × 1
100	132.4	BLRCH520A624B69 × 2	LVR05X00B60T × 1	LC1D115 × 1	LV430841 × 1

Can type capacitors mechanical characteristics



Case Code: DC, EC, FC, HC & LC.

Case Code: DC, HC & LC

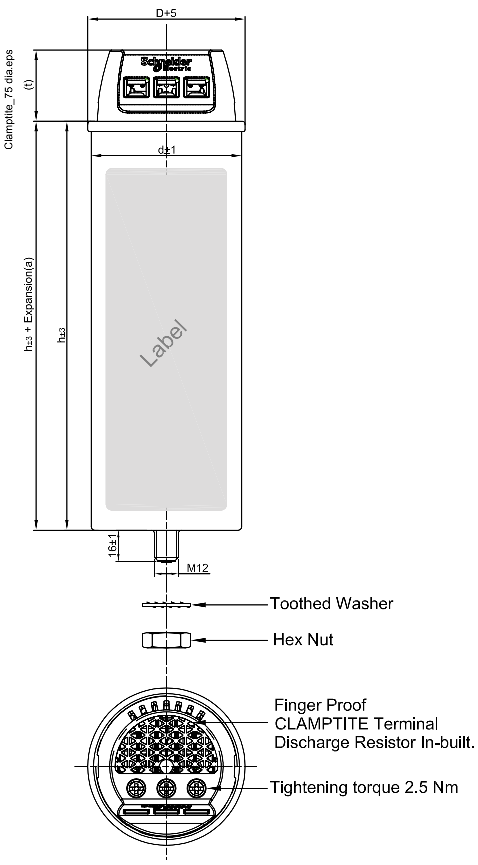
Creepage distance	min.16 mm
Clearance	min.16 mm
Expansion (a)	max.10 mm

Mounting details (for M10/M12 mounting stud)

Torque	M10: 7 N.m M12: 10 N.m
Toothed washer	M10/M12
Hex nut	M10/M12
Terminal assembly Ht. (t)	50 mm

Size (d)	TS	TH
Ø 50	M10	10 mm
Ø 63	M12	13 mm
Ø 70	M12	16 mm

Case code	Diameter d (mm)	Height h (mm)	Height h + t (mm)	Weight (kg)
DC	50	195	245	0.7
EC	63	90	140	0.5
FC	63	115	165	0.5
HC	63	195	245	0.9
LC	70	195	245	1.1



Case Code: MC, NC, RC & SC.

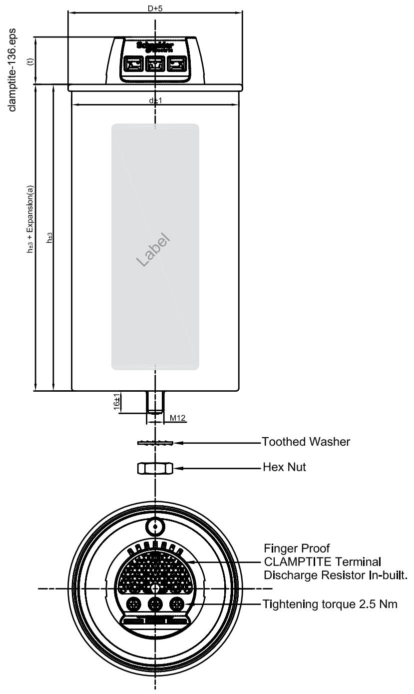
Case Code: MC, NC, RC & SC

Creepage distance	min.13 mm
Clearance	min.13 mm
Expansion (a)	max.12 mm

Mounting details (for M12 mounting stud)

Torque	T = 10 Nm
Toothed washer	J12.5 DIN 6797
Hex nut	BM12 DIN 439
Terminal screw	M5
Terminal assembly Ht. (t)	30 mm

Case code	Diameter d (mm)	Height h (mm)	Height h + t (mm)	Weight (kg)
MC	75	203	233	1.2
NC	75	278	308	1.2
RC	90	212	242	1.6
SC	90	278	308	2.3



Case Code: TC, UC & VC.

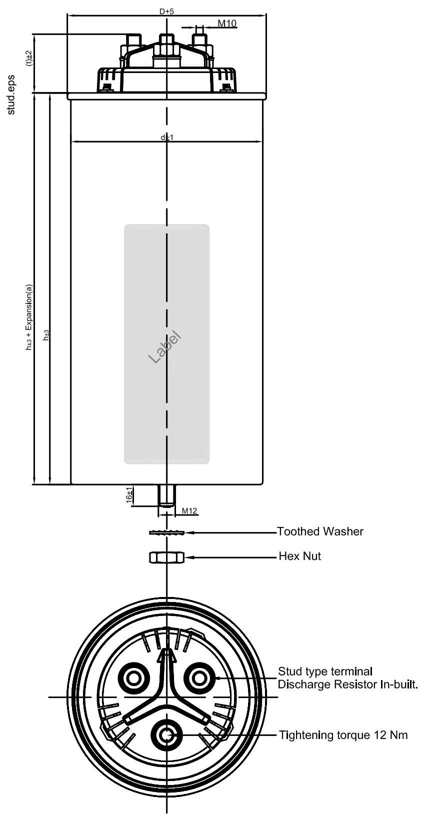
Case Code: TC, UC & VC

Creepage distance	min.13 mm
Clearance	min.13 mm
Expansion (a)	max.12 mm

Mounting details (for M12 mounting stud)

Torque	T = 10 Nm
Toothed washer	J12.5 DIN 6797
Hex nut	BM12 DIN 439
Terminal screw	M5
Terminal assembly Ht. (t)	30 mm

Case code	Diameter d (mm)	Height h (mm)	Height h + t (mm)	Weight (kg)
TC	116	212	242	2.5
UC	116	278	308	3.5
VC	136	212	242	3.2



Case Code: XC & YC.

Case Code: XC & YC

Creepage distance	min.13 mm
Clearance	34 mm
Expansion (a)	max.17 mm

Mounting details (for M12 mounting stud)

Torque	T = 10 Nm
Toothed washer	J12.5 DIN 6797
Hex nut	BM12 DIN 439
Terminal screw	M10
Terminal assembly Ht. (t)	43 mm

Case code	Diameter d (mm)	Height h (mm)	Height h + t (mm)	Weight (kg)
XC	116	278	321	4.1
YC	136	278	321	5.3

VarPlus Box

A robust, safe, reliable and high-performance solution for power factor correction in standard operating conditions.

PE90137

VarPlus Box

Operating conditions

- Optimum solution for stand alone PF compensation
- For networks with significant non-linear loads (NLL ≤ 20 %).
- Standard operating temperature up to 55 °C.
- Significant number of switching operations up to 7,000/year.
- Long life expectancy up to 130,000 hours.

VarPlus Box – Answer for high performance with robustness

Robustness

- Double metallic protection.
- Mechanically well suited for “stand-alone” installations.

Safety

- Its unique safety feature electrically disconnects the capacitors safely at the end of their useful life.
- The disconnectors are installed on each phase, which makes the capacitors very safe, in addition to the protective steel enclosure.
- Use of Aluminum inside the steel enclosure eliminates the risk of any fire hazards unlike with plastic cells.

High performance

- Heavy edge metallization/wave-cut edge to ensure high inrush current capabilities and high current handling.
- Special resistivity and profile metallization for better self-healing & enhanced life.

Technology

Constructed internally with three single-phase capacitor elements.

The design is specially adapted for mechanical stability. The enclosures of the units are designed to ensure that the capacitors operate reliably in hot and humid tropical conditions, without the need of any additional ventilation louvres (see technical specifications).

Special attention is paid to equalization of temperatures within the capacitor enclosures since this gives better overall performance.

Benefits

- Robustness with double metal protection (Aluminum cans inside steel box)
- Suitable for individual compensation with stand alone installation.
  - Direct connection to a machine, in harsh environmental conditions.
- Dual safety
  - Pressure Sensitive Disconnector(PSD) in aluminum cans with metal enclosure

Technical specifications

General characteristics		
Standards		IEC 60831-1/2
Voltage range		400 to 830 V
Frequency		50 / 60 Hz
Power range		5 to 60 kvar
Losses (dielectric)		< 0.2 W/kvar
Losses (total)		< 0.5 W/kvar
Capacitance tolerance		-5 %, +10 %
Voltage test	Between terminals	2.15 x U_N (AC), 10 s
	Between terminal & container	≤ 525 V: 3 kV (AC), 10 s or 3.66 kV (AC), 2 s > 525 V: 3.66 kV (AC), 10 s or 4.4 kV (AC), 2 s
	Impulse voltage	≤ 690 V: 8 kV > 690 V: 12 kV
Discharge resistor		Fitted, standard discharge time 60 s
Working conditions		
Ambient temperature		-25 / 55 °C (Class D)
Humidity		95 %
Altitude		2,000 m above sea level
Overvoltage		1.1 x U_N 8h in every 24 h
Overcurrent		Up to 1.8 x I_N
Peak inrush current		250 x I_N
Switching operations (max.)		Up to 7,000 switching operations per year
Mean Life expectancy		Up to 130,000 hrs
Harmonic content withstand		N_{LL} ≤ 20 %
Installation characteristics		
Mounting position		Indoor, upright
Fastening		Mounting cleats
Earthing		
Terminals		Bushing terminals designed for large cable termination
Safety features		
Safety		Self-healing + Pressure-sensitive disconnector for each phase + Discharge device
Protection		IP20
Construction		
Casing		Sheet steel enclosure
Dielectric		Metallized polypropylene film with Zn/Al alloy. special resistivity & profile. Special edge (wave-cut)
Impregnation		Non-PCB, polyurethene sticky resin.

⚠ WARNING

HAZARD OF ELECTRICAL SHOCK

Wait 5 minutes after isolating supply before handling

Failure to follow these instructions can result in injury or equipment damage

VarPlus Box

Rated Voltage 380/400/415 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
380 V	400 V	415 V	at 400 V	380 V	400 V	415 V	at 400 V			
4.5	**5.0**	5.4	7.2	5.4	**6.0**	6.5	8.7	**33.1**	AB	**BLRBH050A060B40**
7.5	**8.3**	8.9	12.0	9.0	**10.0**	10.8	14.4	**55.0**	AB	**BLRBH083A100B40**
9.4	**10.4**	11.2	15.0	11.3	**12.5**	13.5	18.0	**68.9**	AB	**BLRBH104A125B40**
11.3	**12.5**	13.5	18.0	13.5	**15.0**	16.1	21.7	**82.9**	AB	**BLRBH125A150B40**
13.6	**15.1**	16.3	21.8	16.3	**18.1**	19.5	26.1	**100.1**	GB	**BLRBH151A181B40**
18.1	**20.1**	21.6	29.0	21.8	**24.1**	25.9	34.8	**133.2**	GB	**BLRBH201A241B40**
18.8	**20.8**	22.4	30.0	22.6	**25.0**	26.9	36.1	**137.9**	GB	**BLRBH208A250B40**
22.6	**25.0**	26.9	36.1	27.1	**30.0**	32.3	43.3	**165.7**	GB	**BLRBH250A300B40**
37.6	**41.7**	44.9	60.2	45.1	**50.0**	53.8	72.2	**276.4**	IB	**BLRBH417A500B40**
45.1	**50.0**	53.8	72.2	---	**---**	---		**331.4**	IB	**BLRBH500A000B40**

Rated Voltage 480 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
400 V	415 V	480 V	at 480 V	400 V	440 V	480 V	at 480 V			
6.1	6.6	**8.8**	10.6	7.3	8.9	**10.6**	12.7	**40.5**	AB	**BLRBH088A106B48**
7.2	7.8	**10.4**	12.5	8.7	10.5	**12.5**	15.0	**47.9**	AB	**BLRBH104A125B48**
8.7	9.3	**12.5**	15.0	10.4	12.6	**15.0**	18.0	**57.5**	AB	**BLRBH125A150B48**
10.8	11.7	**15.6**	18.8	13.0	15.7	**18.7**	22.5	**71.8**	GB	**BLRBH156A187B48**
11.9	12.8	**17.1**	20.6	14.3	17.2	**20.5**	24.7	**78.7**	GB	**BLRBH171A205B48**
14.4	15.5	**20.8**	25.0	17.3	21.0	**25.0**	30.0	**95.7**	GB	**BLRBH208A250B48**
17.9	19.3	**25.8**	31.0	21.5	26.0	**31.0**	37.2	**118.8**	IB	**BLRBH258A310B48**
20.0	21.5	**28.8**	34.6	24.0	29.0	**34.6**	41.6	**132.6**	IB	**BLRBH288A346B48**
21.9	23.5	**31.5**	37.9	26.3	31.8	**37.8**	45.5	**145.0**	IB	**BLRBH315A378B48**
23.5	25.3	**33.9**	40.8	28.3	34.2	**40.7**	48.9	**156.1**	IB	**BLRBH339A407B48**
29.0	31.2	**41.7**	50.2	34.8	42.0	**50.0**	60.2	**192.0**	IB	**BLRBH417A500B48**
43.0	46.3	**61.9**	74.5	---	---	**---**		**284.9**	IB	**BLRBH619A000B48**

Rated Voltage 525 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
415 V	480 V	525 V	at 525 V	400 V	480 V	525 V	at 525 V			
6.2	8.4	**10.0**	11.0	7.0	10.0	**12.0**	13.2	**38.5**	AB	**BLRBH100A120B52**
7.8	10.4	**12.5**	13.7	8.7	12.5	**15.0**	16.5	**48.1**	AB	**BLRBH125A150B52**
15.6	20.9	**25.0**	27.5	17.4	25.1	**30.0**	33.0	**96.2**	GB	**BLRBH250A300B52**
25.0	33.4	**40.0**	44.0	27.9	40.1	**48.0**	52.8	**153.9**	IB	**BLRBH400A480B52**

Rated Voltage 600 V

50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
480 V	550 V	600 V	at 600 V	480 V	550 V	600 V	at 600 V			
5.3	7.0	**8.3**	8.0	6.4	8.4	**10.0**	9.6	**24.5**	AB	**BLRBH083A100B60**
6.7	8.7	**10.4**	10.0	8.0	10.5	**12.5**	12.0	**30.6**	AB	**BLRBH104A125B60**
8.0	10.5	**12.5**	12.0	9.6	12.6	**15.0**	14.4	**36.8**	AB	**BLRBH125A150B60**
10.7	14.0	**16.7**	16.1	12.8	16.8	**20.0**	19.3	**49.2**	GB	**BLRBH167A200B60**
13.3	17.5	**20.8**	20.0	16.0	21.0	**25.0**	24.0	**61.3**	GB	**BLRBH208A250B60**

Rated Voltage 690 V										
50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
480 V	**600 V**	**690 V**	**at 690 V**	**480 V**	**600 V**	**690 V**	**at 690 V**			
6.7	10.4	**13.8**	11.5	8.0	12.5	**16.5**	13.8	**30.6**	AB	**BLRBH138A165B69**
7.3	11.3	**15.0**	12.6	8.7	13.6	**18.0**	15.1	**33.4**	GB	**BLRBH151A181B69**
9.7	15.1	**20.0**	16.7	11.6	18.1	**24.0**	20.1	**44.6**	GB	**BLRBH200A240B69**
13.3	20.9	**27.6**	23.1	16.0	25.0	**33.1**	27.7	**61.4**	GB	**BLRBH276A331B69**

Rated Voltage 830 V										
50 Hz				60 Hz				µF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
600 V	**690 V**	**830 V**	**at 830 V**	**600 V**	**690 V**	**830 V**	**at 830 V**			
17.8	23.6	**34.1**	23.7	21.4	28.3	**40.9**	28.5	**52.5**	GB	**BLRBH341A409B83**

VarPlus Box harmonic applications

VarPlus Box capacitors are designed for applications where higher number of non-linear loads are present. Higher current carrying capacity in VarPlus Box allows the operations in stringent conditions. VarPlus Box capactiors are dedicated for standalone applications.

PE90154+PE90134_eps

Detuned reactor   VarPlus Box

Operating conditions

- For networks with a large number of non-linear loads (N_{LL} < 50 %).
- Significant voltage disturbances.
- Very frequent switching operations, up to 7,000/year.

Rated voltage

In a detuned filter application, the voltage across the capacitors is higher than the network service voltage (U_S). Then, capacitors must be designed to withstand higher voltages.

Depending on the selected tuning frequency, part of the harmonic currents is absorbed by the detuned capacitor bank. Then, capacitors must be designed to withstand higher currents, combining fundamental and harmonic currents.

The rated voltage of VarPlus Box capacitors is given in the table below, for different values of network service voltage and relative impedance.

Capacitor Rated Voltage U_N (V)		Network Service Voltage U_s (V)				
		50 Hz		60 Hz		
		400	690	400	480	600
Relative Impedance (%)	5.7 7	480	830	480	575	690
	14	480	-	480	-	-

In the following pages, the effective power (kvar) given in the tables is the reactive power provided by the combination of capacitors and reactors.

VarPlus Box + Detuned Reactor + Contactor + MCCB

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Network 400 V, 50 Hz Capacitor Voltage 480 V 5.7 % / 7 % Detuned Reactor						
Effective Power (kvar)	Q_N at 480 V	Capacitor Ref.	5.7% fr = 210Hz	7% fr = 190Hz	Switching: Contactor Ref.	Protection: Compact NSX (Icu=50kA) Ref.
			D R Ref.	D. R Ref.		
12.5	17.1	BLRBH171A205B48 × 1	LVR05125A40T x 1	LVR07125A40T x 1	LC1D18× 1	LV429846 × 1
25	33.9	BLRBH339A407B48 × 1	LVR05250A40T x 1	LVR07250A40T x 1	LC1D32 × 1	LV429843 × 1
50	67.9	BLRBH339A407B48 × 2	LVR05500A40T x 1	LVR07500A40T x 1	LC1D80 × 1	LV429840 × 1
100	136.2	BLRBH339A407B48 × 4	LVR05X00A40T x 1	LVR07X00A40T x 1	LC1D150 × 1	LV431831 × 1

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Network 400 V, 50 Hz Capacitor Voltage 480 V 14 % Detuned Reactor					
Effective Power (kvar)	Q_N at 480 V	Capacitor Ref.	14% fr = 135Hz	Switching: Contactor Ref.	Protection: Compact NSX (Icu=50kA) Ref.
			D R Ref.		
12.5	15.6	BLRBH156A187B48 × 1	LVR14125A40T x 1	LC1D18× 1	LV429846 × 1
25	31.5	BLRBH315A378B48 × 1	LVR14250A40T x 1	LC1D32 × 1	LV429844 × 1
50	61.9	BLRBH619A000B48 × 1	LVR14500A40T x 1	LC1D80 × 1	LV429841 × 1
100	123.8	BLRBH619A000B48 × 2	LVR14X00A40T x 1	LC1D150 × 1	LV430840 × 1

Network 690 V, 50 Hz Capacitor Voltage 830 V 5.7 % / 7 % Reactor						
Effective Power (kvar)	Q_N at 830 V	Capacitor Ref.	5.7% fr = 210Hz	7% fr = 190Hz	Switching: Contactor Ref.	Protection: Compact NSX ((Icu=10kA)
			D R Ref.	D. R Ref.		
25	34.1	BLRBH341A409B83 × 1	LVR05250A69T × 1	LVR07250A69T × 1	LC1D25 × 1	LV429845 × 1
50	68.2	BLRBH341A409B83 × 2	LVR05500A69T × 1	LVR07500A69T × 1	LC1D50 × 1	LV429842 × 1
100	136.4	BLRBH341A409B83 × 4	LVR05X00A69T × 1	LVR07X00A69T × 1	LC1D80 × 1	LV430841 × 1

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Network 400 V, 60 Hz Capacitor Voltage 480 V 5.7 % / 7 % Detuned Reactor						
Effective Power (kvar)	Q_N at 480 V	Capacitor Ref.	5.7% fr = 250Hz	7% fr = 230Hz	Switching: Contactor Ref.	Protection: Compact NSX (Icu=50kA) Ref.
			D R Ref.	D. R Ref.		
25	34.6	BLRBH288A346B48 × 1	LVR05250B40T × 1	LVR07250B40T × 1	LC1D32 × 1	LV429843 × 1
50	69.2	BLRBH288A346B48 × 2	LVR05500B40T × 1	LVR07500B40T × 1	LC1D80 × 1	LV429840 × 1
100	138.4	BLRBH288A346B48 × 4	LVR05X00B40T × 1	LVR07X00B40T × 1	LC1D150 × 1	LV431831 × 1

Network 400 V, 60 Hz Capacitor Voltage 480 V 14 % Detuned Reactor					
Effective Power (kvar)	Q_N at 480 V	Capacitor Ref.	14% fr = 160Hz	Switching: Contactor Ref.	Protection: Compact NSX (Icu=50kA) Ref.
			D R Ref.		
25	31	BLRBH258A310B48 × 1	LVR14250B40T × 1	LC1D25 × 1	LV429844 × 1
50	62	BLRBH258A310B48 × 2	LVR14500B40T × 1	LC1D50 × 1	LV429841 × 1
100	124	BLRBH258A310B48 × 4	LVR14X00B40T × 1	LC1D150 × 1	LV430840 × 1

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Network 600 V, 60 Hz Capacitor Voltage 690 V 5.7 % Detuned Reactor					
Effective Power (kvar)	Q_N at 690 V	Capacitor Ref.	5.7% fr = 250Hz	Switching: Contactor Ref.	Protection: Compact NSX (Icu=20kA) Ref.
			D R Ref.		
25	33.1	BLRBH276A331B69 × 1	LVR05250B60T × 1	LC1D25 × 1	LV429845 × 1
50	66.2	BLRBH276A331B69 × 2	LVR05500B60T × 1	LC1D50 × 1	LV429842 × 1
100	132.4	BLRBH276A331B69 × 4	LVR05X00B60T × 1	LC1D115 × 1	LV430841 × 1

VarPlus Box Energy

A unique solution for harsh environments which operates up to 70°C delivering extra safety, reliability and high-performance.

VarPlus Box Energy

Operating conditions

- For networks with significant non-linear loads: (NLL < 25 %) and severe voltage disturbances.
- Highest operating temperature (up to 70°C).
- High switching frequency, up to 10,000/year
- Maximum current withstand 2.5 x $I_{N.}$

VarPlus Box Energy – Unique solution for higher operating temperature

Made for harsh environments

- Special technology – Double metalized paper impregnated in oil followed by a unique processing cycle - to deliver high performance in the harsh environments
- Suitable for high operating temperatures (up to 70°C).

Robustness

- Double metallic protection.
- Mechanically well suited for “stand-alone” installations.

Safety

- Its unique safety feature electrically disconnects the capacitors safely at the end of their useful life.
- The disconnectors are installed on each phase, which makes the capacitors very safe, in addition to the protective steel enclosure.
- Use of Aluminum inside the steel enclosure eliminates the risk of any fire hazards unlike with plastic cells.

High performance

- Double metalized paper dielectric ensure maximum continuous current up to 2.5 x I_N.
- Oil acts as a cooling media for the elements to minimize the risk of hot spot generation and increase the life of capacitor.

Technology

Special technology of double metalized paper impregnated in oil to provide extra long life for your capacitor needs in worst environments. Constructed internally with three single-phase capacitor elements.

The design is specially adapted for mechanical stability. The enclosures of the units are designed to ensure that the capacitors operate reliably in hot and humid tropical conditions, without the need of any additional ventilation louvres (see technical specifications).

Energy capacitors are the only technology which is capable of giving the longest life, highest overload limits and the highest operating ambient temperature due to use of the combination of polypropylene film and metallized paper.

Benefits

- Life expectancy up to 160,000hrs
- Operating temperature up to 70°C
- Designed for harsh environments
- Robustness with double metal protection (Aluminum cans inside steel box)
- Dual safety - PSD in aluminum cans with metal enclosure

Technical specifications

General characteristics		
Standards		IEC 60831-1/-2
Voltage range		400 to 525 V
Frequency		50 / 60 Hz
Power range		10 to 60 kvar
Losses (dielectric)		< 0.2 W / kvar
Losses (total)		< 0.5 W / kvar
Capacitance tolerance		-5 %, +10 %
Voltage test	Between terminals	2.15 x U_N (AC), 10 s
	Between terminal & container	3 kV (AC), 10 s or 3.66 kV (AC), 2 s
	Impulse voltage	8 kV
Discharge resistor		Fitted, standard discharge time 60 s
Working conditions		
Ambient temperature		-25 / 70°C
Humidity		95 %
Altitude		2,000 m above sea level
Overvoltage		1.1 x U_N 8 h in every 24 h
Overcurrent		Up to 2.5 x I_N
Peak inrush current		350 x I_N
Switching operations (max.)		Up to 10 ,000 switching operations per year
Mean Life expectancy		Up to 160,000 hrs
Harmonic content withstand		$N_{LL} \leq 25$ %
Installation characteristics		
Mounting position		Indoor & upright
Fastening		Mounting cleats
Earthing		
Terminals		Bushing terminals designed for large cable termination
Safety features		
Safety		Self-healing + Pressure-sensitive disconnector for each phase + Discharge device
Protection		IP20
Construction		
Casing		Sheet steel enclosure
Dielectric		Double metallized paper + polypropylene film
Impregnation		Non-PCB, oil

⚠ WARNING

HAZARD OF ELECTRICAL SHOCK

Wait 5 minutes after isolating supply before handling

Failure to follow these instructions can result in injury or equipment damage

VarPlus Box Energy

Rated Voltage 380/400/415 V

50 Hz				60 Hz				μF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
380 V	400 V	415 V	at 400 V	380 V	400 V	415 V	at 400 V			
11.3	**12.5**	**13.5**	18.0	13.5	**15.0**	**16.1**	21.7	**82.9**	GB	**BLRBE125A150B40**
13.5	**15.0**	**16.1**	21.7	16.2	**18.0**	**19.4**	26.0	**99.4**	GB	**BLRBE150A180B40**
15.1	**16.7**	**18.0**	24.1	18.1	**20.0**	**21.5**	28.9	**110.7**	GB	**BLRBE167A200B40**
18.8	**20.8**	**22.4**	30.0	22.6	**25.0**	**26.9**	36.1	**137.9**	GB	**BLRBE208A250B40**
22.6	**25.0**	**26.9**	36.1	27.1	**30.0**	**32.3**	43.3	**165.7**	GB	**BLRBE250A300B40**
37.6	**41.7**	**44.9**	60.2	45.1	**50.0**	**53.8**	72.2	**276.4**	IB	**BLRBE417A500B40**
45.1	**50.0**	**53.8**	72.2	54.2	**60.0**	**64.6**	86.6	**331.4**	IB	**BLRBE500A600B40**

Rated Voltage 480 V

50 Hz				60 Hz				μF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
400 V	415 V	480 V	at 480 V	400 V	415 V	480 V	at 480 V			
8.7	**9.3**	**12.5**	15.0	10.4	**12.6**	**15.0**	18.0	**57.5**	FB	**BLRBE125A150B48**
9.4	**10.2**	**13.6**	16.4	11.3	**13.7**	**16.3**	19.6	**62.6**	FB	**BLRBE136A163B48**
10.8	**11.6**	**15.5**	18.6	12.9	**15.6**	**18.6**	22.4	**71.4**	GB	**BLRBE155A186B48**
11.8	**12.7**	**17.0**	20.4	14.2	**17.1**	**20.4**	24.5	**78.3**	GB	**BLRBE170A204B48**
14.4	**15.5**	**20.8**	25.0	17.3	**21.0**	**25.0**	30.0	**95.7**	GB	**BLRBE208A250B48**
17.9	**19.3**	**25.8**	31.0	21.5	**26.0**	**31.0**	37.2	**118.8**	IB	**BLRBE258A310B48**
20.0	**21.5**	**28.8**	34.6	24.0	**29.0**	**34.6**	41.6	**132.6**	IB	**BLRBE288A346B48**
21.9	**23.5**	**31.5**	37.9	26.3	**31.8**	**37.8**	45.5	**145.0**	IB	**BLRBE315A378B48**
23.5	**25.3**	**33.9**	40.8	28.3	**34.2**	**40.7**	48.9	**156.1**	IB	**BLRBE339A407B48**
29.0	**31.2**	**41.7**	50.2	34.8	**42.0**	**50.0**	60.2	**192.0**	IB	**BLRBE417A500B48**

Rated Voltage 525 V

50 Hz				60 Hz				μF (X3)	Case Code	Reference Number
Q_N (kvar)			I_N (A)	Q_N (kvar)			I_N (A)			
415 V	480 V	525 V	at 525 V	415 V	480 V	525 V	at 525 V			
6.2	**8.4**	**10.0**	11.0	7.0	**10.0**	**12.0**	13.2	**38.5**	DB	**BLRBE100A120B52**
7.8	**10.4**	**12.5**	13.7	8.7	**12.5**	**15.0**	16.5	**48.1**	FB	**BLRBE125A150B52**
15.6	**20.9**	**25.0**	27.5	17.4	**25.1**	**30.0**	33.0	**96.2**	GB	**BLRBE250A300B52**
31.2	**41.8**	**50.0**	55.0	34.8	**50.2**	**60.0**	66.0	**192.4**	IB	**BLRBE500A600B52**

VarPlus Box Energy Harmonic applications

VarPlus Box Energy capacitors with detuned reactors are designed to operate in harsh environments.

PE30154+PE30134_reps

Detuned reactor *VarPlusBox Energy*

Operating conditions

- For networks with a large number of non-linear loads (N_{LL} < 50 %).
- Significant voltage disturbances.
- Severe temperature conditions up to 70 °C.
- Very frequent switching operations up to 10,000/year.

Rated voltage

In a detuned filter application, the voltage across the capacitors is higher than the network service voltage (U_S). Then, capacitors must be designed to withstand higher voltages.

Depending on the selected tuning frequency, part of the harmonic currents is absorbed by the detuned capacitor bank. Then, capacitors must be designed to withstand higher currents, combining fundamental and harmonic currents.

The rated voltage of VarPlusBox Energy capacitors is given in the table below, for different values of network service voltage and relative impedance.

Capacitor Rated Voltage U_N (V)		**Network Service Voltage U_S (V)**	
		50 Hz	**60 Hz**
		400	**400**
Relative Impedance (%)	5.7 7	**480**	**480**
	14	**480**	**480**

In the following pages, the effective power (kvar) given in the tables is the reactive power provided by the combination of capacitors and reactors.

VarPlus Box Energy + Detuned Reactor + Contactor + MCCB

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Network 400 V, 50 Hz Capacitor Voltage 480 V 5.7 % / 7 % Detuned Reactor

Effective Power (kvar)	Q_N at 480V	Capacitor Ref.	5.7% fr = 210Hz D R Ref.	7% fr = 190Hz D R Ref.	Switching: Contactor Ref.	Protection: Compact NSX (Icu=50kA) Ref.
12.5	17	BLRBE170A204B48 × 1	LVR05125A40T x 1	LVR07125A40T x 1	LC1D18× 1	LV429846 × 1
25	33.9	BLRBE339A407B48 × 1	LVR05250A40T x 1	LVR07250A40T x 1	LC1D32 × 1	LV429843 × 1
50	67.9	BLRBE339A407B48 × 2	LVR05500A40T x 1	LVR07500A40T x 1	LC1D80 × 1	LV429840 × 1
100	136.2	BLRBE339A407B48 × 4	LVR05X00A40T x 1	LVR07X00A40T x 1	LC1D150 × 1	LV431831 × 1

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Network 400 V, 50 Hz Capacitor Voltage 480 V 14 % Detuned Reactor

Effective Power (kvar)	Q_N at 480V	Capacitor Ref.	14% fr = 135Hz D R Ref.	Switching: Contactor Ref.	Protection: Compact NSX (Icu=50kA) Ref.
12.5	15.5	BLRBE155A186B48 × 1	LVR14125A40T x 1	LC1D18× 1	LV429846 × 1
25	31.5	BLRBE315A378B48 × 1	LVR14250A40T x 1	LC1D32 × 1	LV429844 × 1
50	63	BLRBE619A000B48 × 1	LVR14500A40T x 1	LC1D80 × 1	LV429841 × 1
100	126.3	BLRBE619A000B48 × 2	LVR14X00A40T x 1	LC1D150 × 1	LV430840 × 1

Network 400 V, 60 Hz Capacitor Voltage 480 V 5.7 % / 7 % Detuned Reactor

Effective Power (kvar)	Q_N at 480V	Capacitor Ref.	5.7% fr = 250Hz D R Ref	7% fr = 230Hz D R Ref	Switching: Contactor Ref.	Protection: Compact NSX (Icu=50kA) Ref.
25	34.6	BLRBE288A346B48 × 1	LVR05250B40T × 1	LVR07250B40T × 1	LC1D32 × 1	LV429843 × 1
50	67.9	BLRBE288A346B48 × 2	LVR05500B40T × 1	LVR07500B40T × 1	LC1D80 × 1	LV429840 × 1
100	135.8	BLRBE288A346B48 × 4	LVR05X00B40T × 1	LVR07X00B40T × 1	LC1D150 × 1	LV431831 × 1

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Network 400 V, 60 Hz Capacitor Voltage 480 V 14 % Detuned Reactor

Effective Power (kvar)	Q_N at 480V	Capacitor Ref.	14% fr = 160Hz D R Ref.	Switching: Contactor Ref.	Protection: Compact NSX (Icu=50kA) Ref.
25	31	BLRBE258A310B48 × 1	LVR14250B40T × 1	LC1D25 × 1	LV429844 × 1
50	61.9	BLRBE516A619B48 × 1	LVR14500B40T × 1	LC1D50 × 1	LV429841 × 1
100	123.8	BLRBE516A619B48 × 2	LVR14X00B40T × 1	LC1D150 × 1	LV430840 × 1

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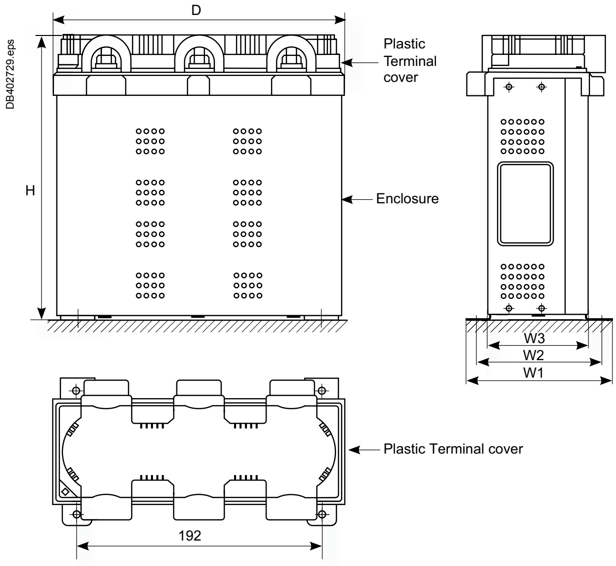
Box type capacitor
Mechanical characteristics

Case Code: AB - VarPlus Box Compact dimension

Creepage distance		30 mm
Clearance		
	Phase to phase	25 mm (min.)
	Phase to earth	19 mm (min.)

Mounting details: mounting screw M6, 2 Nos.

Case code	W1 (mm)	W2 (mm)	W3 (mm)	H (mm)	D (mm)	Weight (kg)
AB	114	97	76.5	229.5	225.5	3

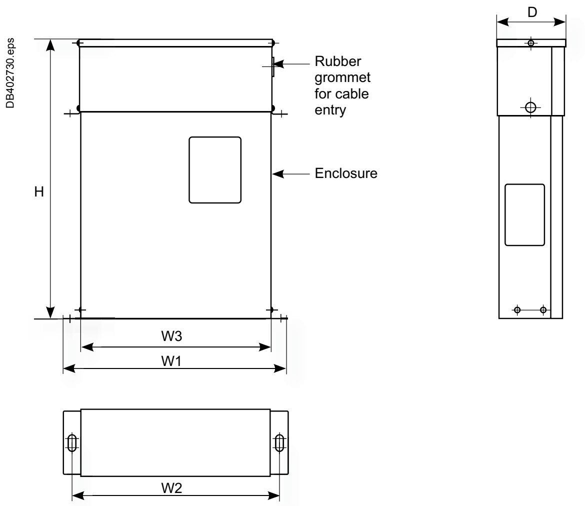


Case Code: DB, EB, FB, GB & HB

Creepage distance		30 mm
Clearance		
	Phase to phase	25 mm (min.)
	Phase to earth	19 mm (min.)

Mounting details: mounting screw M6, 2 Nos.

Case code	W1 (mm)	W2 (mm)	W3 (mm)	H (mm)	D (mm)	Weight (kg)
DB	263	243	213	355	97	4.8
EB	263	243	213	260	97	3.6
FB	309	289	259	355	97	5.4
GB	309	289	259	355	153	7.5
HB	309	289	259	455	153	8.0



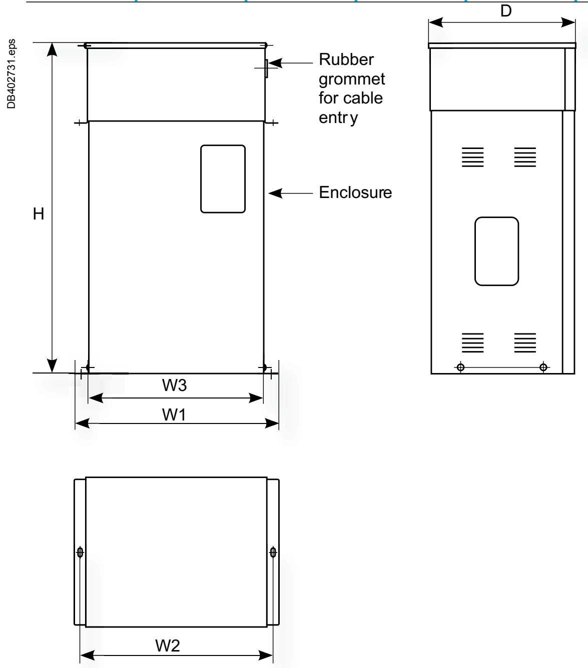
Box type capacitor
Mechanical characteristics

Case Code: IB

Creepage distance		30 mm
Clearance		
	Phase to phase	25 mm (min.)
	Phase to earth	19 mm (min.)

Mounting details: mounting screw M6, 2 Nos.

Case code	W1 (mm)	W2 (mm)	W3 (mm)	H (mm)	D (mm)	Weight (kg)
IB	309	289	259	497	224	10.0



Contents

Detuned reactors

The detuned reactors (DR) are designed to protect the capacitors by preventing amplification of the harmonics present on the network.

PE90154.eps

Operating conditions

- Use: indoor.
- Storage temperature: -40 °C, +60 °C.
- Relative humidity in operation: 20-80 % .
- Salt spray withstand: 250 hours (for 400 V - 50 Hz range).
- Operating temperature:
  - altitude: ≤ 1000 m: Min = 0 °C, Max = 55 °C, highest average over 1 year = 40 °C, 24 hours = 50 °C.
  - altitude: ≤ 2000 m: Min = 0 °C, Max = 50°C, highest average over 1 year = 35 °C, 24 hours = 45°C.

Installation guidelines

- Forced ventilation required.
- Vertical detuned reactor winding for better heat dissipation.

As the detuned reactor is provided with thermal protection, the normally closed dry contact must be used to disconnect the step in the event of overheating.

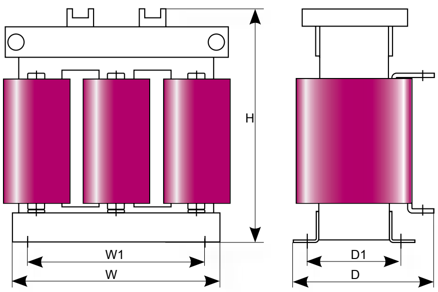
Technical specifications

General characteristics	
Description	Three-phase, dry, magnetic circuit, impregnated
Degree of protection	IP00
Insulation class	H
Rated voltage	400 to 690 V - 50 Hz
	400 to 600 V - 60 Hz
	Other voltages on request
Inductance tolerance per phase	-5, +5 %
Insulation level	1.1 kV
Dielectric test 50/60 Hz between windings and windings/earth	4 kV, 1 min
Thermal protection	Restored on terminal block 250 V AC, 2 A

Let's define the service current (I_S) as the current absorbed by the capacitor and detuned reactor assembly, when a purely sinusoidal voltage is applied, equal to the network service voltage (V).
I_S = Q (kvar) / ($\sqrt{3}$ x U_S)

In order to operate safely in real conditions, a detuned reactor must be designed to accept a maximum permanent current (I_{MP}) taking account of harmonic currents and voltage fluctuations.
The following table gives the typical percentage of harmonic currents considered for the different tuning orders.

(%)	*Harmonic currents*			
Tuning order / Relative Impedance	i_3	i_5	i_7	i_{11}
2.7 / 14%	**5**	**15**	**5**	**2**
3.8 / 7%	**3**	**40**	**12**	**5**
4.2 / 5.7%	**2**	**63**	**17**	**5**



For dimensions and more details, please consult us.

Detuned reactor has to be protectced from over currents with MCCB. A 1.1 factor is applied in order to allow long-term operation at a supply voltage up to (1.1 x U_S).
The maximum perment current (I_{MP}) is given in the following table:

Tuning order	I_{MP} (times I_S)
2.7 / 14%	1.12
3.8 / 7%	1.2
4.2 / 5.7%	1.3

Detuned reactors

Network voltage 400 V, 50 Hz

50 Hz

Relative Impedance (%)	kvar	Inductance (mH)	I_{MP} (A)	Max losses at I_{MP} (W)	W (mm)	W1 (mm)	D (mm)	D1 (mm)	H (mm)	Weight (kg)	Reference Number
5.70% (4.2)	6.5	4.727	12	100	240	200	160	125	220	9	**LVR05065A40T**
	12.5	2.445	24	150	240	200	160	125	220	13	**LVR05125A40T**
	25	1.227	47	200	240	200	160	125	220	18	**LVR05250A40T**
	50	0.614	95	320	260	200	200	125	270	24	**LVR05500A40T**
	100	0.307	190	480	350	200	220	125	350	46	**LVR05X00A40T**
7% (3.8)	6.5	5.775	11	100	240	200	160	125	220	8	**LVR07065A40T**
	12.5	2.987	22	150	240	200	160	125	220	10	**LVR07125A40T**
	25	1.499	43	200	240	200	160	125	220	15	**LVR07250A40T**
	50	0.750	86	320	260	200	200	125	270	22	**LVR07500A40T**
	100	0.375	172	480	350	200	220	125	350	37	**LVR07X00A40T**
14% (2.7)	6.5	11.439	10	100	240	200	160	125	220	10	**LVR14065A40T**
	12.5	6.489	20	150	240	200	160	125	220	15	**LVR14125A40T**
	25	3.195	40	200	240	200	160	125	220	22	**LVR14250A40T**
	50	1.598	80	400	260	200	200	125	270	33	**LVR14500A40T**
	100	0.799	160	600	350	200	220	125	350	55	**LVR14X00A40T**

Network voltage 690 V, 50 Hz

Relative Impedance (%)	kvar	Inductance (mH)	I_{MP} (A)	Max losses at I_{MP} (W)	W (mm)	W1 (mm)	D (mm)	D1 (mm)	H (mm)	Weight (kg)	Reference Number
5.70% (4.2)	12.5	7.28	13.3	150	240	200	160	125	220	13	**LVR05125A69T**
	25	3.654	27	200	240	200	160	125	220	18	**LVR05250A69T**
	50	1.827	53	320	260	200	200	125	270	30	**LVR05500A69T**
	100	0.913	106	600	350	200	220	125	350	42	**LVR05X00A69T**
7% (3.8)	12.5	8.893	12	150	240	200	160	125	220	13	**LVR07125A69T**
	25	4.464	24	200	240	200	160	125	220	18	**LVR07250A69T**
	50	2.232	47	320	260	200	200	125	270	22	**LVR07500A69T**
	100	1.116	94	480	350	200	220	125	350	40	**LVR07X00A69T**

Network voltage 230 V, 50 Hz

Relative Impedance (%)	kvar	Inductance (mH)	I_{MP} (A)	Max losses at I_{MP} (W)	W (mm)	W1 (mm)	D (mm)	D1 (mm)	H (mm)	Weight (kg)	Reference Number
5.70% (4.2)	6.5	1.651	20	100	240	200	160	125	220	8	**LVR05065A23T**
	12.5	0.794	42	150	240	200	160	125	220	13	**LVR05125A23T**
	25	0.397	84	200	240	200	160	125	220	18	**LVR05250A23T**

Detuned reactors

Network voltage 400 V, 60 Hz

60 Hz

Relative Impedance (%)	kvar	Inductance (mH)	I_{MP} (A)	Max losses at I_{MP}(W)	W (mm)	W1 (mm)	D (mm)	D1 (mm)	H (mm)	Weight (kg)	Reference Number
5.70% (4.2)	12.5	2.005	24	150	240	200	160	125	220	10	LVR05125B40T
	25	1.000	48.1	200	240	200	160	125	220	17	LVR05250B40T
	50	0.500	96.3	320	260	200	200	125	270	22	LVR05500B40T
	100	0.250	192.5	480	350	200	220	125	350	39	LVR05X00B40T
7% (3.8)	12.5	2.450	21.8	150	240	200	160	125	220	9	LVR07125B40T
	25	1.221	43.8	200	240	200	160	125	220	15	LVR07250B40T
	50	0.611	87.6	320	260	200	200	125	270	22	LVR07500B40T
	100	0.305	175.3	480	350	200	220	125	350	35	LVR07X00B40T
14% (2.7)	12.5	5.139	21	150	240	200	160	125	220	13	LVR14125B40T
	25	2.704	39.9	200	240	200	160	125	220	18	LVR14250B40T
	50	1.352	79.8	400	260	200	200	125	270	33	LVR14500B40T
	100	0.676	159.7	600	350	200	220	125	350	54	LVR14X00B40T

Network voltage 480 V, 60 Hz

5.70% (4.2)	12.5	2.764	20.9	150	240	200	160	125	220	13	LVR05125B48T
	25	1.421	40.6	200	240	200	160	125	220	18	LVR05250B48T
	50	0.710	81.3	320	260	200	200	125	270	25	LVR05500B48T
	75	0.474	121.9	480	350	200	220	125	350	35	LVR05X00B48T
	100	0.355	162.6	480	350	200	220	125	350	40	LVR05X00B48T
	150	0.237	243.9	600	350	200	220	125	350	50	LVR05X00B48T

Network voltage 220 V, 60 Hz

5.70% (4.2)	12.5	0.618	42.8	150	240	200	160	125	220	13	LVR05125B22T
	25	0.309	85.6	200	240	200	160	125	220	18	LVR05250B22T
	50	0.155	171.2	320	260	200	200	125	270	29	LVR05500B22T
	100	0.077	342.3	480	350	200	220	125	350	39	LVR05X00B22T

Network voltage 240 V, 60 Hz

5.70% (4.2)	12.5	0.665	43.4	150	240	200	160	125	220	13	LVR05125B24T
	25	0.332	86.9	200	240	200	160	125	220	18	LVR05250B24T
	50	0.166	173.7	320	260	200	200	125	270	29	LVR05500B24T

Network voltage 600 V, 60 Hz

5.70% (4.2)	12.5	4.345	16.6	150	240	200	160	125	220	13	LVR05125B60T
	25	2.165	33.3	200	240	200	160	125	220	18	LVR05250B60T
	50	1.083	66.7	320	260	200	200	125	270	24	LVR05500B60T
	75	0.722	100.0	480	350	200	220	125	350	35	LVR05750B60T
	100	0.541	133.3	480	350	200	220	125	350	40	LVR05X00B60T
	150	0.361	200.0	600	350	200	220	125	350	56	LVR05X50B60T

Contents

Varlogic series
RT6, NR6/NR12, NRC12

The Varlogic controllers permanently monitor the reactive power of the installation and control the connection and disconnection of capacitor steps in order to obtain the targeted power factor.

PE90155.eps

Varlogic RT6/8/12**
**: on request*

PE90161.eps

Varlogic NR6/12

PE90156.eps

Varlogic NRC12

Performance
- Permanent monitoring of the network and equipment.
- Information provided about equipment status.
- Alarm signals transmitted in case of anomaly (for NR6, NR12, NRC12).
- Communication by Modbus protocol (for NRC12).
- New control algorithm designed to reduce the number of switching operations and quickly attain the targeted power factor.

Simplicity
- Simplified programming and possibility of intelligent self set-up.
- Ergonomic layout of control buttons.
- Quick and simple mounting and wiring.
- A special menu allows controller self-configuration.

User-friendliness
The large display allows:
- Direct viewing of installation electrical information and capacitor stage condition.
- Direct reading of set-up configuration.
- Intuitive browsing in the various menus (indication, commissioning, configuration).
- Alarm indication.

Monitoring and protection
Alarms
- Should an anomaly occur on the network or the capacitor bank, alarms are indicated on the screen and alarm contact closure is initiated.
- The alarm message is maintained on the screen once the fault clears until it is manually removed.

Protection
- If necessary, the capacitor steps are automatically disconnected to protect the equipment.

Range

Type	Number of step output contacts	Part number
NR6	6	**52448**
NR12	12	**52449**
NRC12	12	**52450**
RT6	6	**51207**
RT8	8	**51209**
RT12	12	**51213**
Accessories		
Communication RS485 Modbus set for NRC12		**52451**
Temperature external probe for NRC12 type in addition to internal probe allows measurement at the hottest point inside the capacitor bank		**52452**

Technical specifications

General characteristics			
Output relays			
AC	5 A / 120 V	2 A / 250 V	1 A / 400 V
DC	0.3 A / 110 V	0.6 A / 60 V	2 A / 24 V
Protection Index			
Front panel	IP41		
Rear	IP20		
Measuring current	0 to 5 A		
Specific features	**RT6**	**NR-6/12**	**NRC12**
Number of steps	6	6 / 12	12
Supply voltage (V AC) 50/60 Hz		88 to 130	88 to 130
	185 to 265	185 to 265	185 to 265
	320 to 460	320 to 460	320 to 460
Display			
4 digit 7 segment LEDs	■		
65 x 21 mm backlit screen		■	
55 x 28 mm backlit screen			■
Dimensions	143 x 143 x 67	155 x 158 x 70	155 x 158 x 80
Flush panel mounting	■	■	■
35 mm DIN rail mounting (EN 50022)		■	■
Operating temperature	0 °C – 55 °C	0 °C – 60 °C	0 °C – 60 °C
Alarm contact			■
Internal temperature probe			■
Separate fan relay contact		■	■
Alarm history		Last 5 alarms	Last 5 alarms
Type of connection			
Phase-to-neutral		■	■
Phase-to-phase	■	■	■
Current input			
CT… 10000/5 A	■		
CT 25/5 A … 6000/5 A		■	■
CT 25/1 A … 6000/5 A			■
Target cosφ setting			
0.85 ind. … 1	■		
0.85 ind. …0.9 cap.		■	■
Possibility of a dual cosφ target			■
Accuracy	±2 %	±5 %	±2 %
Response delay time	10 to 1800 s	10 to 120 s	10 to 180 s
Reconnection delay time			
10 to 1800 s	■		
10 to 600 s		■	
10 to 900 s			■
4-quadrant operation for generator application			■
Communication protocol			Modbus

Contents

TeSys contactors

For switching 3-phase capacitor banks, used for power factor correction

Direct connection without choke inductors

Special contactors LC1 D•K are designed for switching 3-phase, single- or multiple-step capacitor banks. They comply with standards IEC 60070 and 60831, NFC 54-100, VDE 0560, UL and CSA.

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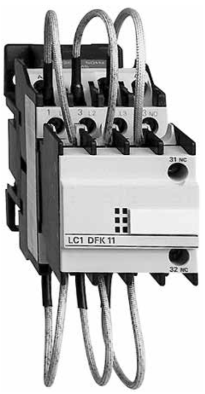


LC1 DFK11●●

PF511556.eps

LC1 DPK12●●

Special contactors

Special contactors **LC1 D•K** are designed for switching 3-phase, single or multiple-step capacitor banks (up to 6 steps). Over 6 steps, it is recommanded to use chokes in order to limit the inrush current and thus improve the lifetime of the installation. The contactors are conform to standards IEC 60070 and 60831, UL and CSA.

Contactor applications

Specification

Contactors fitted with a block of early make poles and damping resistors, limiting the value of the current on closing to 60 In max.
This current limitation increases the life of all the components of the installation, in particular that of the fuses and capacitors.
The patented design of the add-on block (n° 90 119-20) ensures safety and long life of the installation.

Operating conditions

There is no need to use choke inductors for either single or multiple-step capacitor banks. Short-circuit protection must be provided by gI type fuses rated at 1.7…2 In.

Maximum operational power

The power values given in the selection table below are for the following operating conditions:

Prospective peak current at switch-on	LC1 D•K		200 In
Maximum operating rate	LC1 DFK, DGK, DLK, DMK, DPK		240 operating cycles/hour
	LC1 DTK, DWK		100 operating cycles/hour
Electrical durability at nominal load	All contactor ratings	400 V	100 000 operating cycles
		690 V	100 000 operating cycles

Operational power at 50/60 Hz (1) θ ≤ 55 °C (2)			Instantaneous auxiliary contacts		Tightening torque on cable end	Basic reference, to be completed by adding the voltage code (3)	Weight
220 V 240 V	400 V 440 V	660 V 690 V					
kVAR	kVAR	kVAR	N/O	N/C	N.m		kg
6.7	12.5	18	1	2	1.7	**LC1 DFK●●**	0.430
8.5	16.7	24	1	2	1.7	**LC1 DGK●●**	0.450
10	20	30	1	2	2.5	**LC1 DLK●●**	0.600
15	25	36	1	2	2.5	**LC1 DMK●●**	0.630
20	33.3	48	1	2	5	**LC1 DPK●●**	1.300
25	40	58	1	2	5	**LC1 DTK●●**	1.300
40	60	92	1	2	9	**LC1 DWK12●●**	1.650

Switching of multiple-step capacitor banks (with equal or different power ratings)

The correct contactor for each step is selected from the above table, according to the power rating of the step to be switched.
Example: 50 kVAR 3-step capacitor bank. Temperature: 50 °C and U = 400 V or 440 V.
One 25 kVAR step: contactor LC1 DMK, one 15 kVAR step: contactor LC1 DGK, and one 10 kVAR step: contactor LC1 DFK.

(1) Operational power of the contactor according to the scheme on the page opposite.
(2) The average temperature over a 24-hour period, in accordance with standards IEC 60070 and 60831 is 45 °C.
(3) Standard control circuit voltages (the delivery time is variable, please consult your Regional Sales Office):

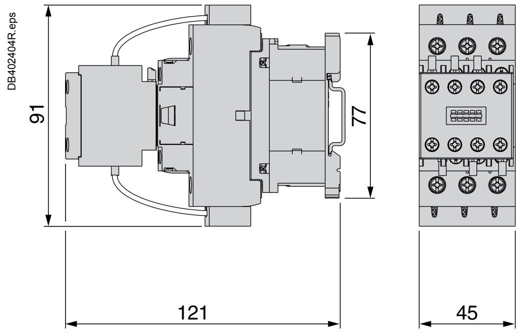
Volts	24	48	120	220	230	240	380	400	415	440
50/60 Hz	B7	E7	G7	M7	P7	U7	Q7	V7	N7	R7

TeSys contactors

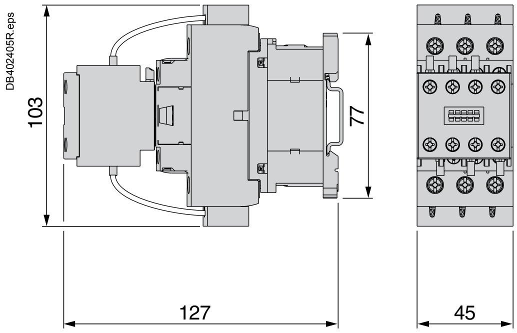
For switching 3-phase capacitor banks, used for power factor correction

Dimensions

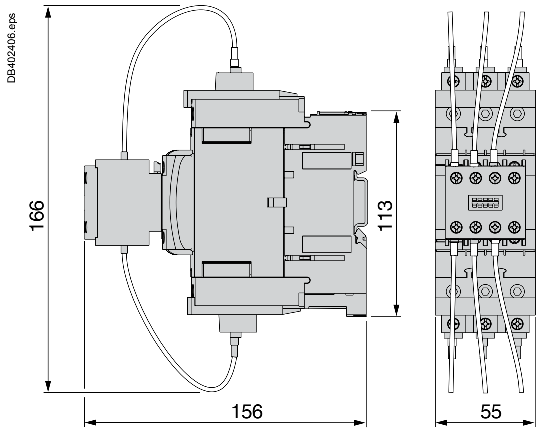
LC1 DFK, DGK



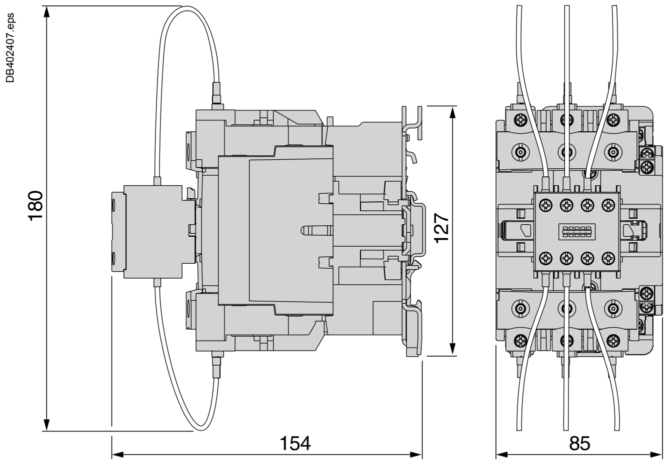
LC1 DLK, DMK



LC1 DPK, DTK

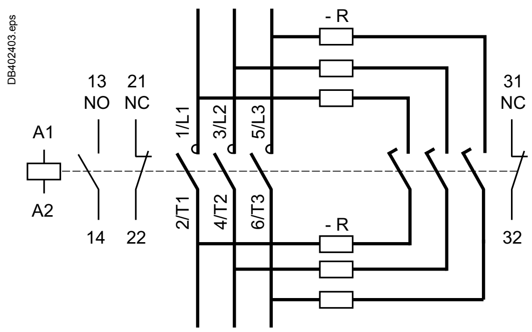


LC1 DWK



Schemes

LC1 D•K



R = Pre-wired resistor connections.

Contents

Influence of harmonics in electrical installations

Since the harmonics are caused by non-linear loads, an indicator for the magnitude of harmonics is the ratio of the total power of non-linear loads to the power supply transformer rating.

This ratio is denoted N_{LL}, and is also known as G_h/S_n:
N_{LL} = Total power of non-linear loads (G_h)/ Installed transformer rating (S_n)

Example:
> Power supply transformer rating: S_n = 630 kVA
> Total power of non-linear loads: G_h = 150 kVA
> N_{LL} = (150/630) x 100 = 24 %.

Definition of harmonics

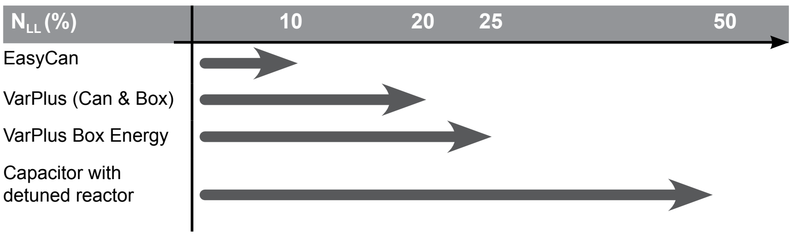
The presence of harmonics in electrical systems means that current and voltage are distorted and deviate from sinusoidal waveforms. Harmonic currents are currents circulating in the networks and whose frequency is an integer multiple of the supply frequency. Harmonic currents are caused by non-linear loads connected to the distribution system. A load is said to be non-linear when the current it draws does not have the same waveform as the supply voltage. The flow of harmonic currents through system impedances in turn creates voltage harmonics, which distort the supply voltage.
The most common non-linear loads generating harmonic currents use power electronics, such as variable speed drives, rectifiers, inverters, etc. Loads such as saturable reactors, welding equipment, and arc furnaces also generate harmonics. Other loads such as inductors, resistors and capacitors are linear loads and do not generate harmonics.

Effects of harmonics

Capacitors are particularly sensitive to harmonic currents since their impedance decreases proportionally to the order of the existing harmonics. This can result in capacitor overload, constantly shortening its operating life. In some extreme situations, resonance can occur, resulting in an amplification of harmonic currents and a very high voltage distortion.
To ensure good and proper operation of the electrical installation, the harmonic level must be taken into account in selecting power factor correction equipment. A significant parameter is the cumulated power of the non-linear loads generating harmonic currents.

Taking account of harmonics

The percentage of non-linear loads N_{LL} is a first indicator for the magnitude of harmonics. The proposed selection of capacitors depending on the value of N_{LL} is given in the diagram below.



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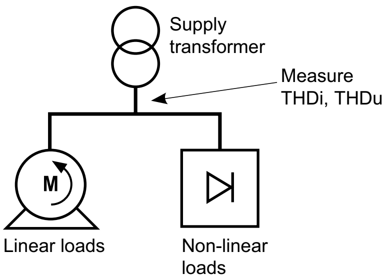
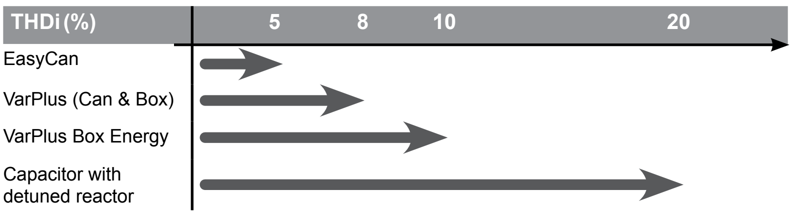
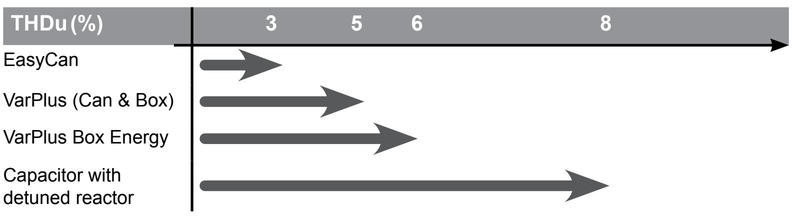


A more detailed estimation of the magnitude of harmonics can be made with measurements. Significant indicators are current harmonic distortion THDi and voltage harmonic distortion THDu, measured at the transformer secondary, with no capacitors connected. According to the measured distortion, different technologies of capacitors shall be selected:





The capacitor technology has to be selected according to the most restrictive measurement.
Example, a measurement is giving the following results :
- THDi = 15 % Harmonic solution.
- THDu = 3.5 % VarPlus solution.
Harmonic solution has to be selected.

Safety features

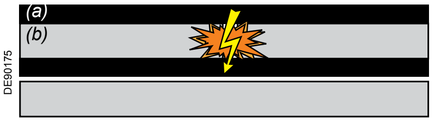


Figure 1 - (a) Metal layer - (b) Polypropylene film.

Figure 2

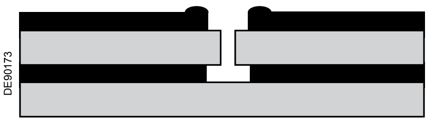


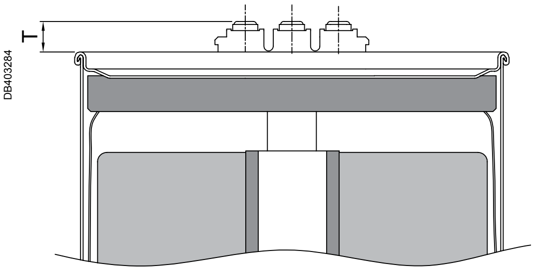
Figure 3

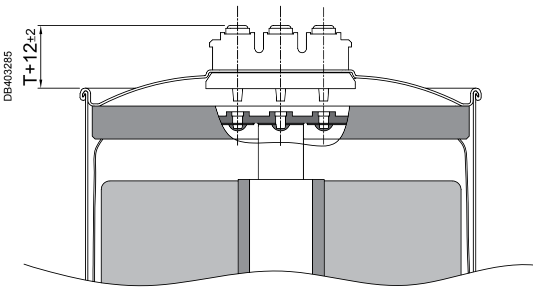
Self-healing is a process by which the capacitor restores itself in the event of a fault in the dielectric which can happen during high overloads, voltage transients etc.

When insulation breaks down, a short duration arc is formed (**figure 1**).

The intense heat generated by this arc causes the metallization in the vicinity of the arc to vaporise (**figure 2**).

Simultaneously it re-insulates the electrodes and maintains the operation and integrity of the capacitor (**figure 3**).





Cross-section view of a three-phase capacitor after Pressure Sensitive Device operated: bended lid and disconnected wires.

Pressure Sensitive Disconnector (also called ‘tear-off fuse’): this is provided in each phase of the capacitor and enables safe disconnection and electrical isolation at the end of the life of the capacitor.

Malfunction will cause rising pressure inside the can. Pressure can only lead to vertical expansion by bending lid outwards. Connecting wires break at intended spots. Capacitor is disconnected irreversibly.

Protection Devices in APFC Panel

Over voltage
In the event of an over voltage, electrical stress on the capacitor dielectric and the current drawn by the capacitors will increase. The APFC equipment must be switched off in the event of over voltage with suitable over voltage relay / surge suppressor.

Over Current
Over current condition is harmful to all current carrying components. The capacitor bank components must be rated based on the maximum current capacity. A suitable over current relay with an alarm function must be used for over current protection.

Short circuit protection
Short circuit protection at the incomer of the capacitor bank must be provided by devices such as MCCB's and ACB's.
It is recommended to use MCB or MCCB for short circuit protection at every step.

Thermal Overload
A thermal overload relay must be used for over load protection and must be set at 1.3 times the rated current of capacitors (as per IEC 60831).
In case of de tuned capacitor banks, the over load setting is determined by the maximum over load capacity of the de tuning reactor. (1.12 = 4.2(14%), 1.19 = 3.8(7%), 1.3 = 2.7(5.7%)).
If MCCB's are not present, it is recommended to use a thermal overload relay with the stage contactor to make sure the stage current does not exceed its rated capacity.

Over Temperature protection
The APFC controller must be tripped with the help of thermostats in cases the internal ambient temperature of the capacitor bank exceeds the temperature withstand characteristics of the capacitor bank components. Reactors are provided with thermal switches and can be isolated in the case of over temperature conditions.

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Glossary

Active current (Ia):
In the vector representation, component of the current vector which is co-linear with the voltage vector.

Active power:
Real power transmitted to loads such as motors, lamps, heaters, computers, and transformed into mechanical power, heat or light.

Apparent power:
In a circuit where the applied r.m.s. voltage is Vrms and the circulating r.m.s. current is Irms, the apparent power S (kVA) is the product: V_{rms} x I_{rms}. The apparent power is the basis for electrical equipment rating.

Detuned reactor:
Reactor associated to a capacitor for Power Factor Correction in systems with significant non-linear loads, generating harmonics. Capacitor and reactor are configured in a series resonant circuit, tuned so that the series resonant frequency is below the lowest harmonic frequency present in the system.

Displacement Power Factor:
For sinusoidal voltage and current with a phase angle φ, the Power Factor is equal to $\cos\varphi$, called Displacement Power Factor (DPF)

Harmonic distortion:
Indicator of the current or voltage distortion, compared to a sinusoidal waveform.

Harmonics:
The presence of harmonics in electrical systems means that current and voltage are distorted and deviate from sinusoidal waveforms. Harmonic currents and voltages are signals circulating in the networks and which frequency is an integer multiple of the supply frequency.

IEC 60831-1:
"Shunt power capacitors of the self-healing type for a.c. systems having a rated voltage up to and including 1 000 V – Part 1: General – Performance, testing and rating – Safety requirements – Guide for installation and operation".

In-rush current:
High-intensity current circulating in one piece of equipment after connection to the supply network.

kVA demand:
Maximum apparent power to be delivered by the Utility, which determines the rating of the supply network and the tariff of subscription.

Polypropylene:
Plastic dielectric material used for the construction of low-voltage capacitors.

Power Factor:
The power factor λ is the ratio of the active power P (kW) to the apparent power S (kVA) for a given circuit.
λ = P (kW) / S (kVA).

Power Factor Correction:
Improvement of the Power Factor, by compensation of reactive energy or harmonic mitigation (reduction of the apparent power S, for a given active power P).
Rated current:
Current absorbed by one piece of equipment when supplied at the rated voltage.

Rated voltage:
Operating voltage for which a piece of equipment has been designed, and which can be applied continuously.

Reactive current (Ir):
Component of the current vector which is in quadrature with the voltage vector.

Reactive power:
Product of the reactive current times the voltage.

Service voltage:
Value of the supply network voltage, declared by the Utility

Service current:
Amplitude of the steady-state current absorbed by one piece of equipment, when supplied by the Service Voltage.

Usual formulas:
Apparent power: S = V_{rms} x I_{rms} (kVA).
Active power: P = V_{rms} x Ia = V_{rms} x I_{rms} x $\cos\varphi$ (kW).
Reactive power: Q = V_{rms} x Ir = V_{rms} x I_{rms} x $\sin\varphi$ (kvar).

Voltage sag:
Temporary reduction of the supply voltage magnitude, between 90 and 1 % of the service voltage, with a duration between ½ period and

Relevant documents

Relevant documents published by Schneider Electric

- Electrical Installation Guide.
- Expert Guide n°4: "Harmonic detection & filtering".
- Expert Guide n°6: "Power Factor Correction and Harmonic Filtering Guide"
- Technical Guide 152: "Harmonic disturbances in networks, and their treatment".
- White paper: controlling the impact of Power Factor and Harmonics on Energy Efficiency.

Relevant websites

- http://www.schneider-electric.com
- https://www.solution-toolbox.schneider-electric.com/segment-solutions
- http://engineering.electrical-equipment.org/
- http://www.electrical-installation.org

Relevant standards

- IEC 60831 - Shunt power capacitors of the self healing for a.c. systems up to 1000V
- IEC 61642 - Application of filters and shunt capacitors for industrial a.c. networks affected by harmonics
- IEC 61921 - Power capacitors-low voltage power factor correction capacitor banks

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