



# LV Capacitors QCap-L series

## Capacitors for power factor correction

Power and productivity  
for a better world™



# ABB and power quality

ABB is a leader in power and automation technologies that enable utility and industry customers to improve their performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 145,000 people.

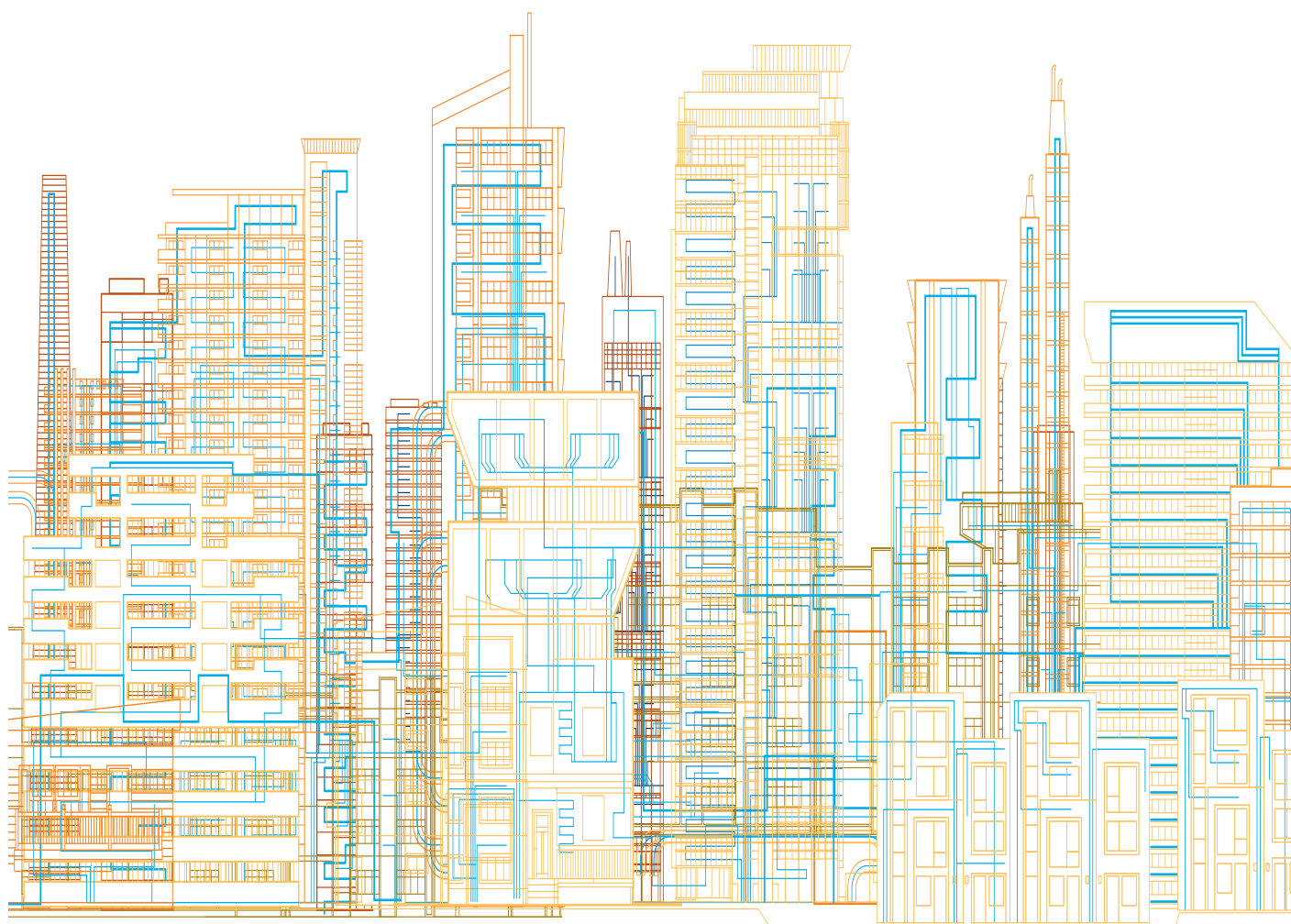
ABB delivers the full value chain in low, medium and high voltage technologies for electrical power transmission, distribution and usage. ABB has been driving development in the field of Power Quality for over 70 years and is responsible for several important developments in reactive power and filtering technologies.

Today, ABB is recognized as a leader in Power Quality, partnering with its customers to define optimal solutions for their system.

## Quality capacitors for power factor correction

Applications such as motors, transformers, induction furnaces, welding and lighting installations consume both reactive and active power, resulting in reduced availability and lower quality of power. This translates into lower capacity utilization and eventually additional capital and running costs.

ABB with its cutting-edge technologies and extensive experience has developed a wide range of advanced Low Voltage (LV) capacitors, which offer simple and cost effective solution to improve power quality and reduce costs.



# LV capacitors QCap-L series

## Product design



ABB's low voltage QCap-L series capacitors consist of a number of wound elements and a dielectric made of metallized polypropylene film. These dry windings are provided with over pressure disconnecter for safety. The capacitor elements are treated in vacuum to ensure optimal electrical characteristics. Each winding is encapsulated in thermo-setting resin to obtain a perfectly sealed element.

The QCap-L series LV Capacitors are available in cylindrical & box type models.

## Product key benefits

- Dry type design - The QCap-L series capacitor has a dry type dielectric which minimizes risk of leakage and environmental pollution
- Very low losses - Dielectric losses within the QCap-L series capacitors are very low and total losses including discharge resistors are less than 0.5 W/ kvar
- High reliability - The use of robust terminals minimize the risk of damage during installation and reduce maintenance requirements
- Accredited with International standards- The QCap-L series low voltage capacitors are IS: 13340/41 and IEC 60831-1&2 compliant

## Product features

Type	Box type	Cylindrical type
		
Construction	<ul style="list-style-type: none"><li>– Dielectric: Polypropylene film</li><li>– Dry PU resin; non-PCB (1 to 4 kvar) in normal duty</li><li>– Soft PU resin; non-PCB (5 kvar up to 25 kvar in normal duty)</li><li>– Container type: MS sheet metal</li><li>– Elements placed inside a metal box, delta connected internally</li><li>– Provided with discharge resistor</li></ul>	<ul style="list-style-type: none"><li>– Dielectric: Polypropylene film</li><li>– Non-PCB, soft PU resin</li><li>– Extruded cylindrical aluminum can with stud</li><li>– Overpressure disconnecter</li><li>– Elements inside an extruded cylindrical aluminum can, delta connected internally</li><li>– Provided with discharge resistor</li></ul>
Features	<ul style="list-style-type: none"><li>– Three phase</li><li>– Self-healing technology</li><li>– Naturally air cooled or forced cooling</li></ul>	<ul style="list-style-type: none"><li>– Three phase</li><li>– Self-healing technology</li><li>– Naturally air cooled or forced cooling</li></ul>
Typical applications	<ul style="list-style-type: none"><li>– For power factor correction in indoor applications</li></ul>	<ul style="list-style-type: none"><li>– For power factor correction in indoor applications</li></ul>

# Range/ Connection type

## Cylindrical type - normal duty

1 kvar to 4 kvar (415 V & 440 V): Fast-on terminal

6.3 kvar to 25 kvar (415 V & 440 V): Screw terminal



## Cylindrical type - heavy duty

1 kvar (415 V): Fast-on terminal

2 kvar and above (415 V): Sigut terminal

1 kvar and 2 kvar (440 V): Fast-on terminal

3 kvar to 25 kvar (440 V): Sigut terminal



## Box type - normal duty

1 to 4 kvar (415 V & 440 V): Wire type terminal

6.3 to 25 kvar (415 V & 440 V): Stud type terminal



## Box type - heavy duty

1 kvar to 25 kvar (415 V & 440 V): Stud terminal



# Technical data

Range	Cylindrical type - normal duty	Cylindrical type - heavy duty	Box type - normal duty	Box type - heavy duty
Voltage (V)	415 / 440 / 480 /525			
Power (kvar)	1 – 25			
Frequency (Hz)	50			
Connection	3 phase as standard construction / Delta			
Maximum permissible temperature category	-40º C to 55º C	-40º C to 60º C	-40º C to 60º C	-40º C to 60º C
Losses (with discharge resistors)	≤ 0.5 W/kVAr			
Maximum permissible voltage	Maximum VR +10% (upto 8h daily)**			
Maximum permissible current	200 x IR*	250 x IR*	200 x IR*	250 x IR*
Safety	Self healing, overpressure disconnecter			
Impregnation	Non- PCB, semi dry biodegradable resin			
Cooling	Natural or forced			
Case shape / finish	Extruded round aluminium can with stud			
Terminal	Screw terminal	Optimized capacitor safety terminals	Screw terminal	Optimized capacitor safety terminals
Mounting parts	Threaded stud at bottom of can (max. torque = 4Nm for M8 & 10 NM for M12)		Mounting bracket at rear plate	
Earth	Extruded stud		Earth connection on the enclosure fixation	
Enclosure	IP 20, indoor mounting (optionally with terminal cap for IP54)			
Discharge resistor	In-built as part of the capacitor			
Execution	Indoor			
Dielectric	Polypropylene film (metallised)			
Mean life expectancy	1,00,000 hours (max. 5000 switching per year)	1,15,000 hours (max. 6000 switching per year)	1,00,000 hours (max. 5000 switching per year)	1,25,000 hours (max. 6000 switching per year)
Mean life expectancy	100,000 hours (max. 5000 switching per year)	115,000 hours (max. 6000 switching per year)	100,000 hours (max. 5000 switching per year)	125,000 hours (max. 6000 switching per year)
Standards	In compliance to IS 13340 / 41 & IEC 60831 – 1 & 2			

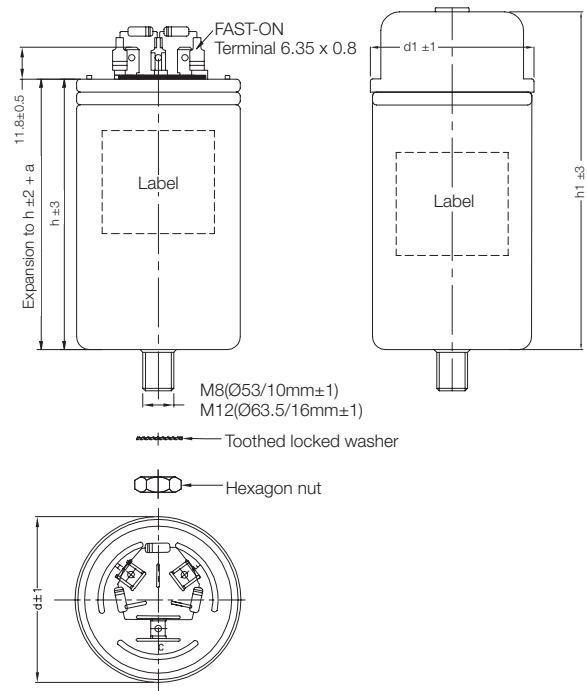
\*IR = Inrush current

Note: Capacitors to be used under normal conditions, not suitable for harmonic environment

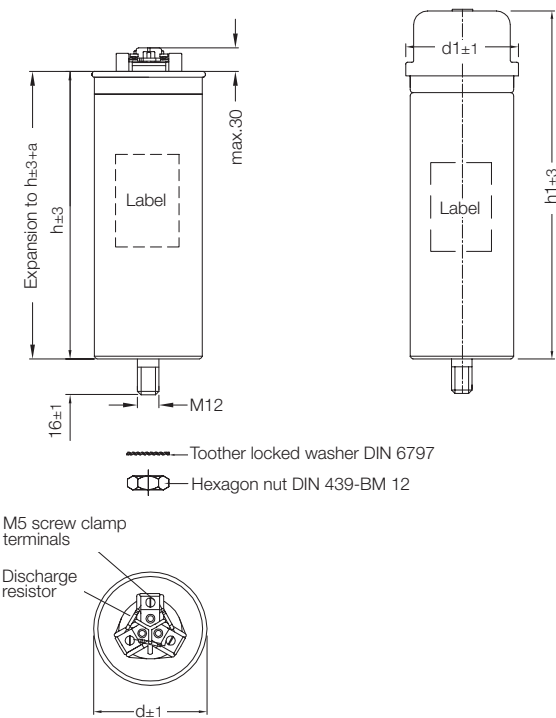
# Dimensions

## Cylindrical type - normal duty

Voltage (V)	Power (Q) kvar	Capacitance (µf)	Rated current (A)	Dimensions (mm) without cap
			50 Hz	D x H
415	1.0	6.5	1.4	53 x 117
	2.0	12.5	2.8	53 x 117
	3.0	18.5	4.2	63.5 x 129
	4.0	25.0	5.6	63.5 x 152
	5.0	31.0	7.0	63.5 x 152
	6.3	39	8.8	78.4 x 195
	7.5	46.5	10.4	78.4 x 195
	10.0	62.0	13.9	88.4 x 195
	12.5	77.0	17.4	88.4 x 270
	15.0	92.5	20.9	88.4 x 270
	20.0	123.5	27.8	88.4 x 345
	25.0	154	34.8	88.4 x 345
440	1.0	5.5	1.3	53 x 117
	2.1	11.5	2.8	53 x 117
	3.0	16.5	3.9	63.5 x 129
	4.2	23.0	5.5	63.5 x 129
	5.0	27.5	6.6	63.5 x 152
	6.0	33	7.9	78.4 x 195
	7.5	41.0	9.8	78.4 x 195
	10.0	55.0	13.1	88.4 x 195
	12.5	68.5	16.4	88.4 x 270
	15.0	82.5	19.7	88.4 x 270
	20.0	110.0	26.2	88.4 x 345
	25.0	137.5	32.8	93.5 x 345



Fast-on terminal

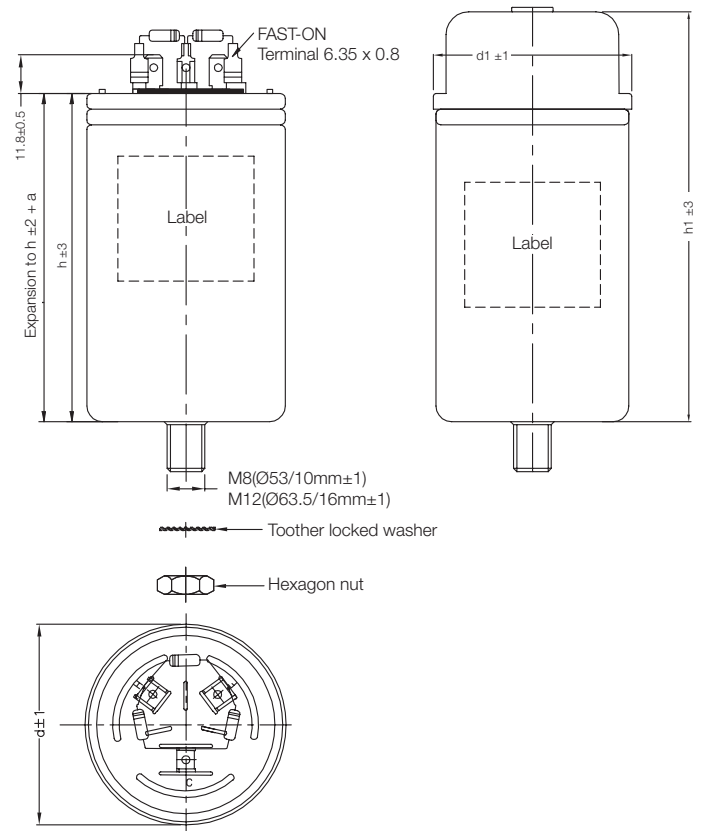


Screw terminal

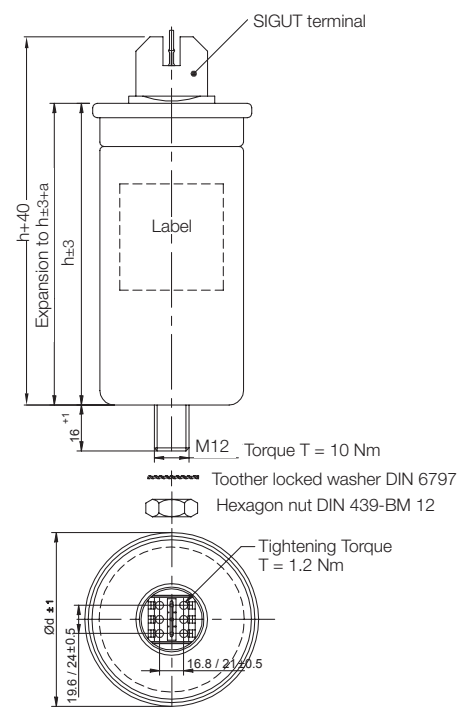
# Dimensions

## Cylindrical type - heavy duty

Voltage (V)	Power (Q) kvar	Capacitance ( $\mu$ f)	Rated current (A)	Dimensions (mm)
				D x H
415	1	6.5	1.4	53 x 129
	2	12.5	2.8	78.4 x 195
	3	19	4.2	78.4 x 195
	4	25	5.6	78.4 x 195
	5	31	7.0	88.4 x 195
	8	49.5	11.1	88.4 x 270
	9	55.5	12.5	88.4 x 270
	10	62	13.9	88.4 x 345
	12.5	77	17.4	88.4 x 345
	15	93.5	20.9	93.5 X 348
	20	123.3	27.8	121.5 x 325
	25	154.1	34.8	142 x 325
440	1	5.5	1.3	53 x 117
	2	11	2.6	63.5 x 129
	3	16.5	3.9	78.4 x 195
	4	22	5.2	78.4 x 195
	5	27.5	6.6	78.4 x 195
	6	33	7.8	88.4 x 195
	7.5	41.5	9.8	88.4 x 270
	10	55	13.1	88.4 x 270
	12.5	68.5	16.4	93.5 X 270
	15	82.5	19.7	105.5 X 280
	20	109.6	26.3	121.5 x 280
	25	137	32.8	121.5 x 325



### Fast-on terminal

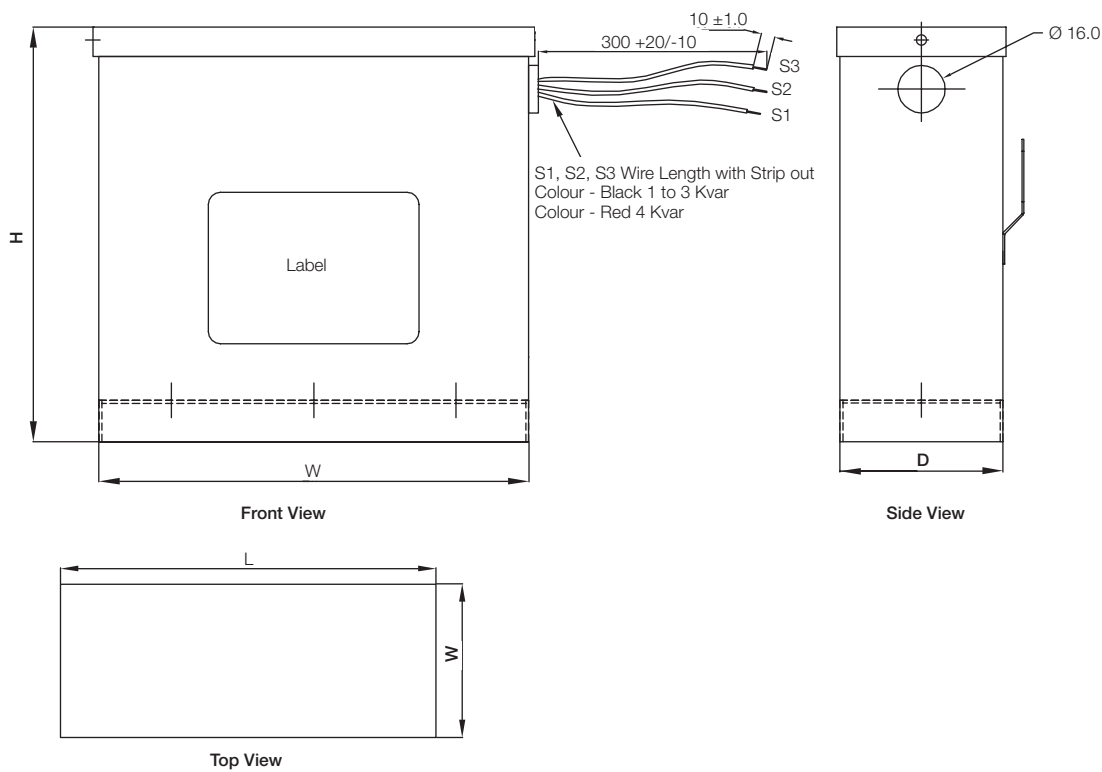


### Sigut terminal

# Dimensions

## Box type - normal duty (1-4 kvar)

Volts V	Range (kvar)	Capacitance µf	Rated current (A)	Dimensions (mm) ±5mm		
				H	W	D
415	1.0	6.2	1.4	95	125	45
415	2.0	12.3	2.8	120	125	45
415	3.0	18.5	4.2	120	145	55
415	4.0	24.7	5.6	140	145	55
440	1.0	5.5	1.3	95	125	45
440	2.0	11.0	2.6	120	125	45
440	3.0	16.4	3.9	120	145	55
440	4.0	21.9	5.3	140	145	55



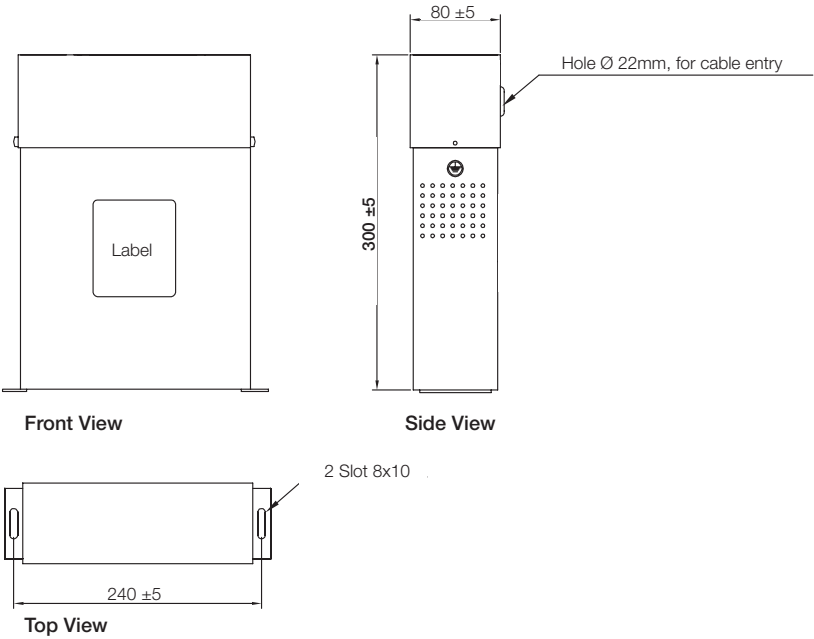
Wire type terminal



# Dimensions

## Box type - normal duty (5-25 kvar)

Volts V	(Range) kvar	Capacitance µf	Rated Current (A)	Dimensions (mm) ±5mm		
				H	W	D
415	5	31	7.0	240	185	60
	6	37.5	8.3	300	240	80
	7.5	46.5	10.4	300	240	80
	10	62	13.9	300	240	80
	12.5	77	17.4	300	240	80
	15	92.5	20.9	300	240	80
	17.5	107.9	24.3	300	240	160
	20	124	27.8	300	240	160
	22.5	138.7	31.3	300	240	160
	25	154	34.8	300	240	160
440	5	27.5	6.6	240	185	60
	6	33	7.9	300	240	80
	7.5	41.5	9.8	300	240	80
	10	55	13.1	300	240	80
	12.5	68.5	16.4	300	240	80
	15	82.5	19.7	300	240	80
	17.5	96	23	300	240	160
	20	110	26.2	300	240	160
	22.5	123.4	29.5	300	240	160
	25	138	32.8	300	240	160

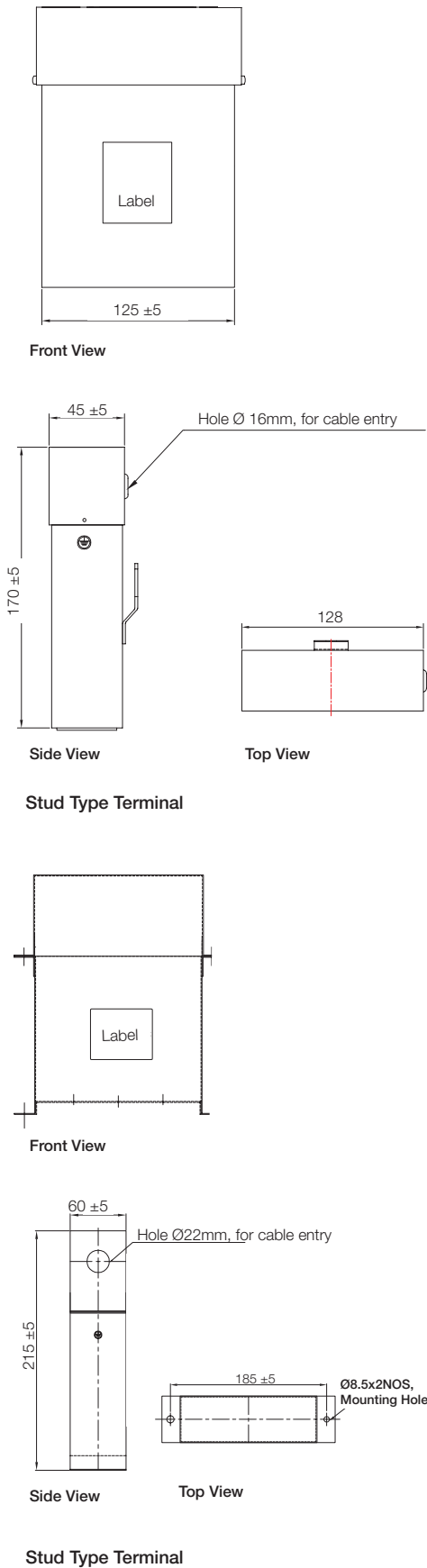


Stud Type Terminal

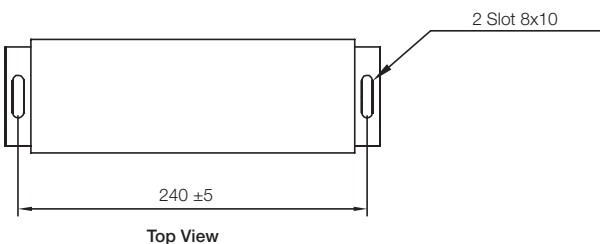
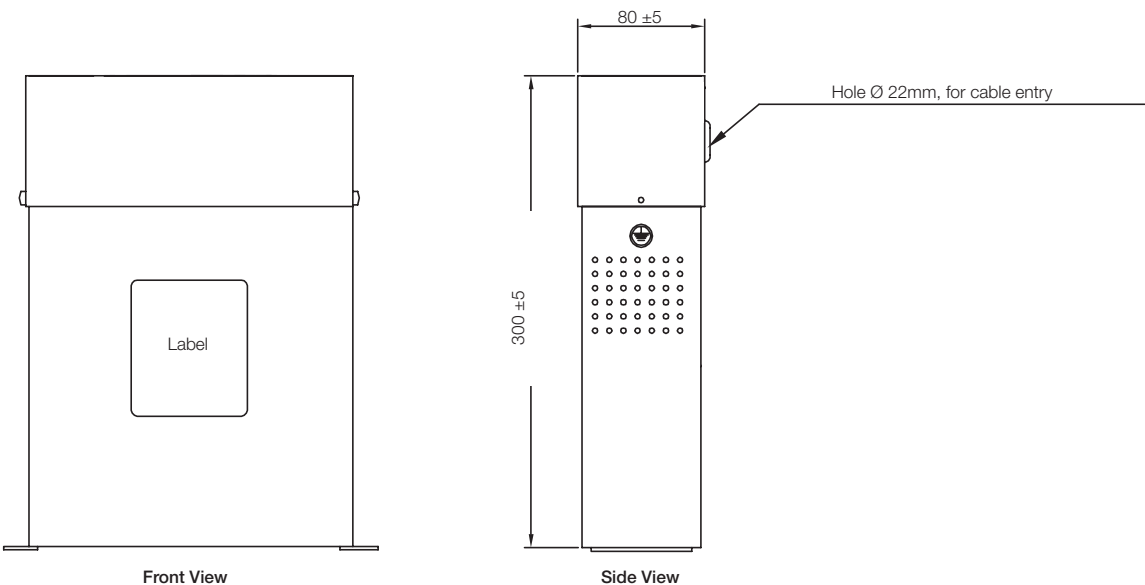
# Dimensions

## Box type - heavy duty

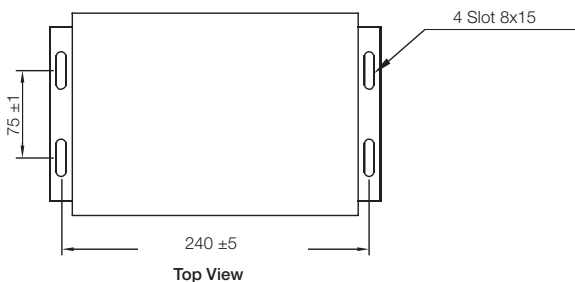
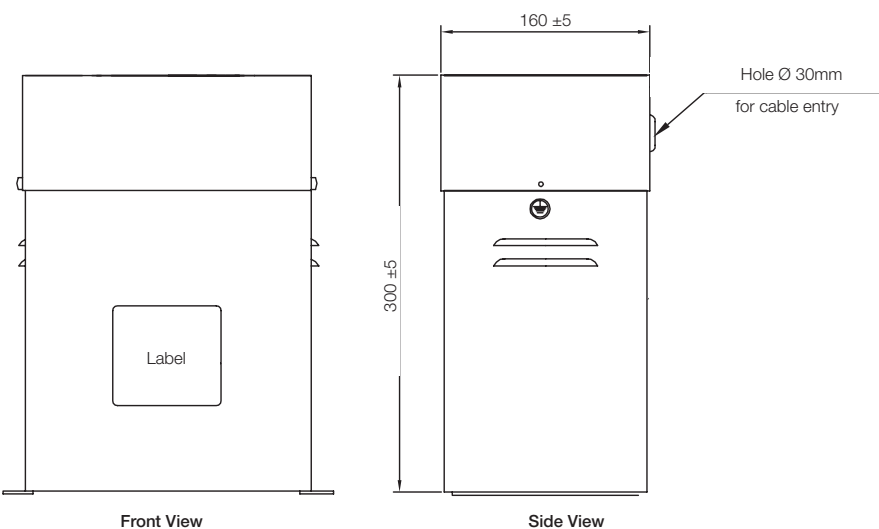
Volts (V)	Range (kvar)	Capacitance $\mu\text{f}$	Rated current (A)	Dimensions (mm) $\pm 5\text{mm}$		
				H	W	D
415	1	6.3	1.4	170	125	45
	2	12.5	2.8	170	125	45
	3	19	4.2	215	185	60
	4	25	5.6	215	185	60
	5	31	7	215	185	60
	6	37.5	8.3	300	240	80
	7.5	49.5	10.4	300	240	80
	10	62	13.9	300	240	80
	12.5	77	17.4	300	240	80
	15	92	20.9	300	240	80
	17.5	107.9	24.3	300	240	160
	20	124	27.8	300	240	160
	22.5	138.7	31.3	300	240	160
	25	154	34.8	300	240	160
440	1	5.5	1.3	170	125	45
	2	11	2.6	170	125	45
	3	16.5	3.9	215	185	60
	4	22	5.2	215	185	60
	5	27.5	6.6	215	185	60
	6	33	7.9	300	240	80
	7.5	41.5	9.8	300	240	80
	10	55	13.1	300	240	80
	12.5	69	16.4	300	240	80
	15	82.5	19.7	300	240	80
	17.5	96	23	300	240	160
	20	110	26.2	300	240	160
	22.5	123.4	29.5	300	240	160
	25	138	32.8	300	240	160



# Dimensions



Stud Type Terminal



Stud Type Terminal

# Contact us

## **ABB India Limited**

### **LV Capacitors**

Plot no. 485/6, 14th Cross  
IV Phase, Peenya Industrial Area  
Bangalore - 560058

Email: [pqc-statcon@in.abb.com](mailto:pqc-statcon@in.abb.com)

[www.abb.co.in](http://www.abb.co.in)

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## Q cap L Cylindrical Capacitor Heavy Duty 525V

### Construction

- n Dielectric: Polypropylene film
- n Non PCB, Soft Polyurethane resin
- n Extruded round aluminium can with stud
- n Provided with discharge resistors
- n Overpressure disconnecter

### Features

- n Three phase, delta connected
- n Self-healing technology
- n Naturally air cooled (or forced air cooling)
- n Internal safety fuse
- n Provided with discharge resistor
- n Indoor mounting

### Typical applications

- n For Power Factor correction

### Terminals

- n Cu Wire terminals for metal top -1 to 5 kvar
- n Screw terminal for metal top – 6.3 to 30 kvar

### Mounting parts

Threaded stud at bottom of can  
(max. torque = 4Nm for M8 & 10Nm for M12 )

### Technical data and specifications

Characteristics	
Rated capacitance $C_R$	As per table
Tolerance	-0 / +10%
Connection	D (Delta)
Rated Voltage	As per table
Rated frequency $f_R$	50 Hz
Output	As per table
Rated current $I_R$	As per table
$\tan \delta_0$ (dielectric)	$\leq 0.2 \text{ W / kvar}$

Maximum ratings	
$V_{\max}$ (up to 8 h daily)	$(V_R + 10\% V_R) \text{ V AC}$
$V_{\max}$ (up to 1 min)	$(V_R + 30\% V_R) \text{ V AC}$
$I_{\max}$	$1.3 * I_R \text{ (A)}$
$I_S$	$150 * I_R \text{ (A)}$



## Q cap L Cylindrical Capacitor Heavy Duty 525V

Test data	
$V_{TT}$	2.15* $V_R$ , AC, 2s
$V_{TC}$	3,600 V AC / 50 Hz, 2 s
* Losses	$\leq 0.5$ W / kvar

\* Without discharge resistor

Climatic category / -10/D	
$T_{min}$	-10 °C
$T_{max}$	+55 °C
Storage temperature	-10 °C to 70 °C
Hot Spot temperature	70 °C
Rel. humidity	max. 95%
Maximum altitude	4,000 m above sea level

Mean life expectancy	
$t_{LD}$	up to 150,000 hours
Max. 5,000 Switchings per year to IEC 60831	

Design data	
Dimensions (d xh)	As per table
Impregnation	Biodegradable soft resin
Fixing	Threaded bolt M12 for case size dia > 50mm M8 for case size dia $\leq$ 50mm
Mounting position	Vertical position. See maintenance & installation manual for further details.

Terminals	
Metal top -1 to 6 kvar	Cu wire
Metal top – 7.5 to 30 kvar	Finger proof terminal
Finger proof terminals	
Degree of protection	Isolated terminals, IP20
Max. torque	1.2 Nm
Cable cross section	Max. 16 mm <sup>2</sup>
Maximum terminal current	50 A
Creepage distance	12.7 mm
Clearance	9.6 mm

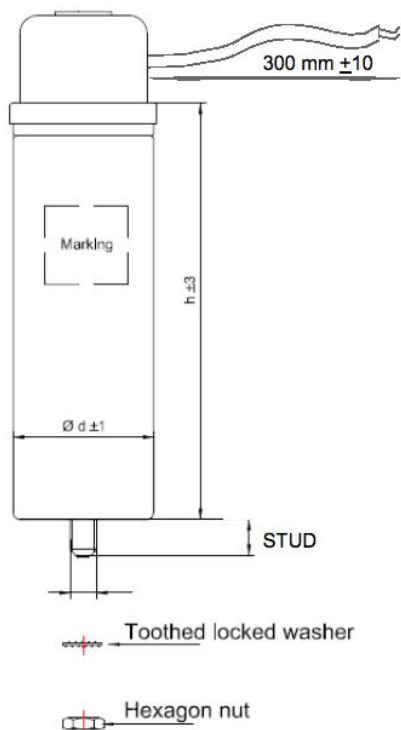
## Q cap L Cylindrical Capacitor Heavy Duty 525V

Safety	
Mechanical safety	Overpressure disconnecter
Max. short circuit current	AFC: 10 kA
Discharge resistor time	$\leq 1$ min (50 V)

Reference Standards
IS: 13340/41
IEC 60831-1&2

### Ordering Codes & Dimensional Drawings:

KVAR	Capacitance uF	Rated Current (A)	Dimensions (mm)		Ordering Code
			d	h	
1.0	3.8	1.1	50	150	
3.0	11.5	3.3	50	150	
4.2	16.2	4.6	63.5	150	
5.0	19.2	5.5	63.5	150	

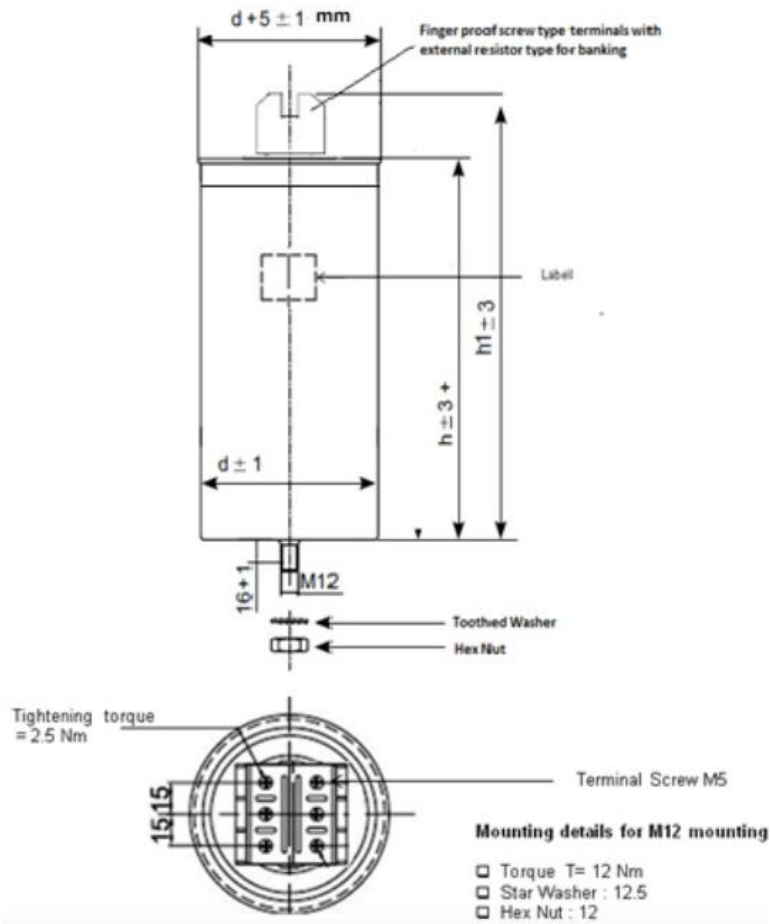


# ABB

## Q cap L Cylindrical Capacitor Heavy Duty 525V

KVAR	Capacitance uF	Rated Current (A)	Dimensions (mm)		
			d	h	
6.3	24.2	6.9	75	154	
6.6	25.4	7.2	75	154	
8.3	31.9	9.1	75	154	
9.9	38.1	10.9	75	272	
10.4	40.0	11.4	75	272	
12.5	48.1	13.7	75	272	
13.2	50.8	14.5	75	272	
16.6	63.9	18.2	85	272	
16.7	64.3	18.3	85	272	
19.9	76.6	21.9	90	272	
20.8	80.0	22.9	90	272	
26.5	102.0	29.1	100	272	
33.1	127.4	36.4	100	347	

\*  $h_1 = h + 40\text{mm} \pm 3$





## Q cap L Cylindrical Capacitor Heavy Duty 525V

### Cautions and warnings

- § In case of dents or any other mechanical damage, capacitors must not be used at all.
- § This applies also in case of oil leakages.
- § To ensure the full functionality of the overpressure disconnecter, elastic elements must not be hindered and a minimum space of 12 mm has to be kept above each capacitor basic cell.
- § Do not handle the capacitor before it is discharged.
- § Resonance cases must be avoided by appropriate application design in any case.
- § Handle capacitors carefully, because they may still be charged even after disconnection due to faulty discharging devices.
- § Protect the capacitor properly against over current and short circuit.
- § Failure to follow cautions may result, worst case, in premature failures, bursting and fire.

### Discharging

Capacitors must be discharged to a maximum of 10% of rated voltage before they are switched in again. This prevents an electric impulse discharge in the application, influences the capacitor's service life and protects against electric shock. The capacitor must be discharged to 50 V or less within 1 minute. There must be not any switch, fuse or any other disconnecting device in the circuit between the power capacitor and the discharging device. Discharge and short circuit capacitor before handling!

### Service life expectancy

Electrical components do not have an unlimited service life expectancy; this applies to self-healing capacitors too. The maximum service life expectancy may vary depending on the application the capacitor is used in.

### Safety

Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result from bursting of the capacitor or from expulsion of oil or melted material due to mechanical disruption of the capacitor.

- § Ensure good, effective grounding for capacitor enclosures.
- § Provide means of disconnecting and insulating a faulty component/bank.
- § The terminals of capacitors, connected bus bars and cables as well as other devices may also be energized.
- § Follow good engineering practice.

### Thermal load/over-temperature

After installation of the capacitor it is necessary to verify that maximum hot-spot temperature is not exceeded at extreme service conditions.

## Q cap L Cylindrical Capacitor Heavy Duty 525V

### Overpressure Disconnect

To ensure full functionality of an overpressure disconnect, the following must be observed:

1. The elastic elements must not be hindered.
2. Maximum allowed fault current of 10000 A in accordance with UL 810 standard must be assured by the application.
2. Stress parameters of the capacitor must be within the IEC60831/IS13340 specification.

### Overcurrent and short circuit protection

- § Use HRC fuses or MCCBs for short circuit protection. Short circuit protection and connecting cables should be selected so that 1.5 times the rated capacitor current can be permanently handled.
- § HRC fuses do not protect a capacitor against overload - they are only for short circuit protection.
- § The HRC fuse rating should be 1.6 to 1.8 times rated capacitor current.
- § Do not use HRC fuses to switch capacitors (risk of arcing).
- § Use thermal magnetic over current relays for overload protection.

### Resonance cases

Resonance cases must be avoided by appropriate application design in any case. Maximum total RMS capacitor current (incl. fundamental harmonic current) specified in technical data must not be exceeded.

### Re-switching vs. phase-opposition

In case of voltage interruption, a sufficient discharge time has to be ensured to avoid phase-opposition and resulting high inrush currents.

### Vibration resistance

The resistance to vibration of capacitors corresponds to IEC 68, part 2–6.

Max. test conditions:

Test duration	6 h*
Frequency range 1	10 ... 55 Hz*
Displacement amplitude	0.75 mm*

\*corresponding to max. 98.1 m/s<sup>2</sup> or 10 g

These figures apply to the capacitor alone. Because the fixing and the terminals may influence the vibration properties, it is necessary to check stability when a capacitor is built in and exposed to vibration. Irrespective of this, you are advised not to locate capacitors where vibration amplitude reaches the maximum in strongly vibrating equipment.

### Mechanical protection

The capacitor has to be installed in a way that mechanical damages and dents in the aluminum can be avoided.

## Q cap L Cylindrical Capacitor Heavy Duty 525V

### Grounding

The threaded bottom stud of the capacitor has to be used for grounding. In case grounding is done via metal chassis that the capacitor is mounted to, the layer of varnish beneath the washer and nut should be removed. The maximum tightening torque is 10 Nm for M12 stud and 4Nm for M8 stud.

### Maintenance

- § Check tightness of the connections/terminals periodically.
- § Take current reading twice a year and compare with nominal current. Use a harmonic analyser or true effective RMS-meter.
- § In case of current above the nominal current check your application for modifications.
- § If a significant increase in the amount of non-linear loads has been detected, then a consultant has to be called in for a harmonic study.
- § In case of the presence of harmonics installation of a de-tuned capacitor bank (reactors) must be considered.
- § Check the temperature of capacitors directly after operation for a longer period, but make sure that the capacitors have been switched off. In case of excessive temperature of individual capacitors, it is recommended to replace these capacitors, as this should be an indication for loss factor increase, which is a sign for reaching end of life.

### Storage and operating conditions

Do not use or store capacitors in corrosive atmosphere, especially where chloride gas, sulphide gas, acid, alkali, salt or the like are present. In dusty environments regular maintenance and cleaning especially of the terminals is required to avoid conductive path between phases and/or phases and ground.

## Q cap L Box Type Capacitor Heavy Duty 440V

### Construction

- n Dielectric: Polypropylene film
- n Non PCB, Soft Polyurethane resin
- n Container type/finish: MS sheet metal / powder coated grey colour RAL-7310, Cable box- RAL 3020
- n Provided with discharge resistors
- n Overpressure disconnecter

### Features

- n Three phase, delta connected
- n Self-healing technology
- n Naturally air cooled (or forced air cooling)
- n Internal safety fuse
- n Provided with discharge resistor
- n Indoor mounting

### Typical applications

- n For Power Factor correction

### Terminals

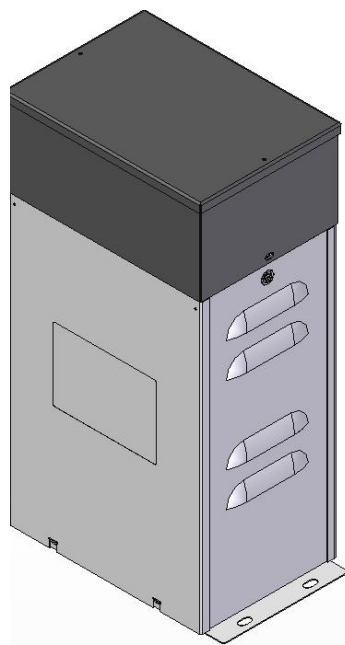
- n Cu Wire terminals – 1 to 6 KVAR
- n Stud terminals with ceramic bushing – 7.5 to 30 KVAR

### Mounting parts

- n Mounting Clamps at back – 1 to 6 KVAR
- n Mounting plates at top & bottom – 7.5 to 30 KVAR

### Technical data and specifications

Characteristics	
Rated capacitance $C_R$	As per table
Tolerance	0 / +10%
Connection	D (Delta)
Rated Voltage	As per table
Rated frequency $f_R$	50 Hz
Output	As per table
Rated current $I_R$	As per table
$\tan \delta_0$ (dielectric)	$\leq 0.2 \text{ W / kvar}$



## Q cap L Box Type Capacitor Heavy Duty 440V

### Maximum ratings

$V_{\max}$ (up to 8 h daily)	$(V_R + 10\% V_R) V_{AC}$
$V_{\max}$ (up to 1 min)	$(V_R + 30\% V_R) V_{AC}$
$I_{\max}$	$1.5 \cdot I_R (A)$
$I_S$	$250 \cdot I_R (A)$

### Test data

$V_{TT}$	$2.15 \cdot V_R, AC, 2s$
$V_{TC}$	$3,600 V_{AC} / 50 Hz, 2s$
* Losses (single phase cell)	$\leq 0.5 W / kvar$

\* Without discharge resistor

### Climatic category / -10/D

$T_{\min}$	$-10\text{ }^{\circ}C$
$T_{\max}$	$+55\text{ }^{\circ}C$
Storage temperature	$-10\text{ }^{\circ}C$ to $70\text{ }^{\circ}C$
Hot Spot temperature	$70\text{ }^{\circ}C$
Rel. humidity	max. 95%
Maximum altitude	4,000 m above sea level

### Mean life expectancy

$t_{LD}$	up to 120,000 hours
Max. 6,000 switchings per year to IEC 60831	

### Design data

Dimensions (H x W x D)	As per table
Impregnation	Biodegradable soft resin
Fixing	Mounting clamps or plates
Mounting position	Vertical position. See maintenance and installation manual for further details.

### Terminals

Metal top -1 to 6 kvar	Cu wire
Metal top – 7.5 to 30 kvar	Studs with ceramic bushing

## Q cap L Box Type Capacitor Heavy Duty 440V

### Safety

Mechanical safety	Overpressure disconnecter
Max. short circuit current	AFC: 10 kA
Discharge resistor time	≤ 1 min (50 V)

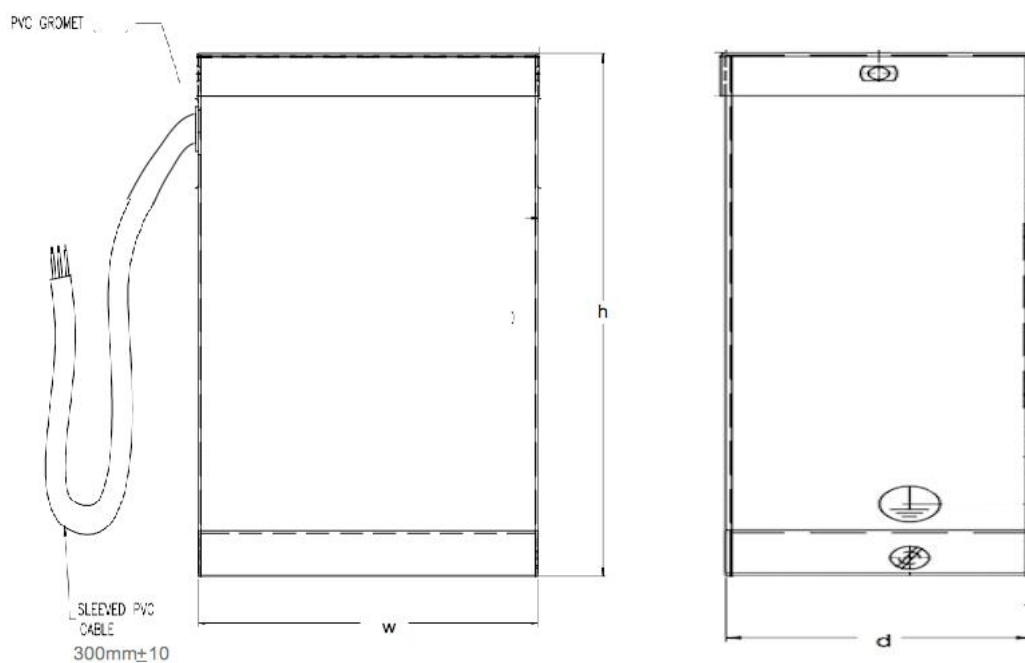
### Reference Standards

IS: 13340/41

IEC 60831 - 1&2

### Ordering Codes & Dimensional drawing:

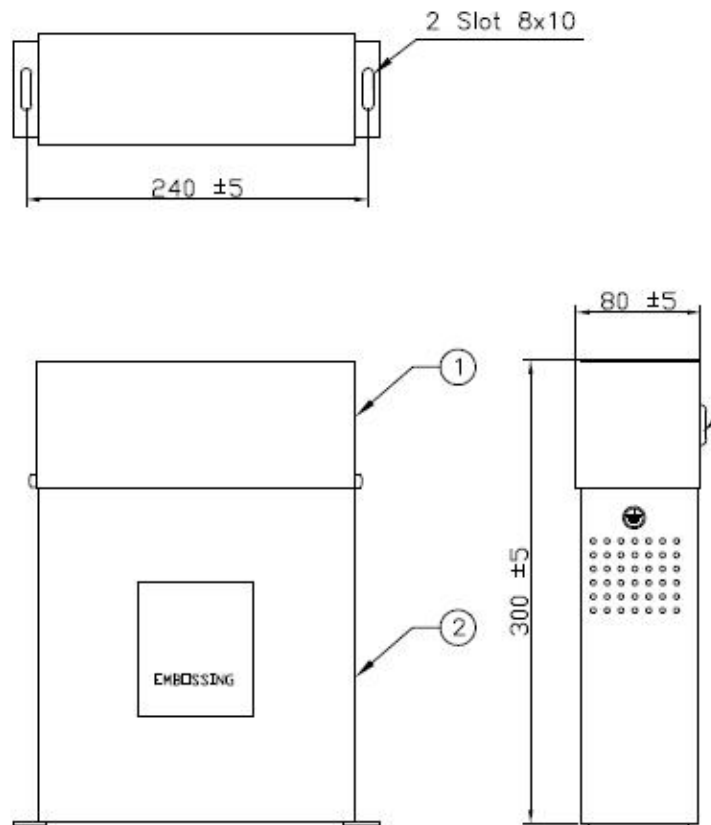
KVAR	Capacitance	Rated current	Dimensions (mm)			Article No.
	(μf)	(A)	H	W	D	
1.0	5.5	1.3	175	60	60	1HYC414012-101-1
2.0	11.0	2.6	200	75	75	1HYC414012-102-1
3.0	16.4	3.9	200	75	75	1HYC414012-103-1
4.0	21.9	5.3	200	75	75	1HYC414012-104-1
5.0	27.4	6.6	240	180	60	1HYC414012-105-1
6.0	32.9	8.0	240	180	60	1HYC414012-106-1



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## Q cap L Box Type Capacitor Heavy Duty 440V

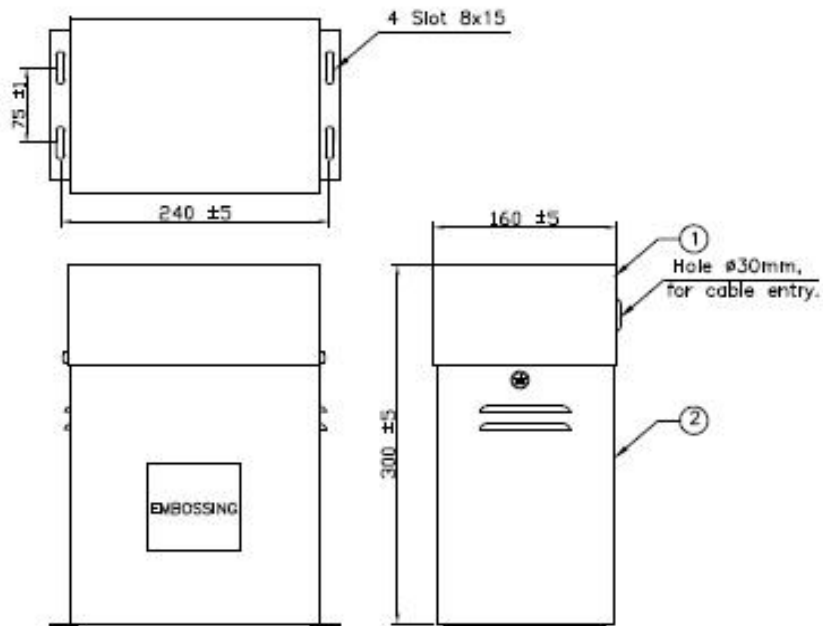
KVAR	Capacitance	Rated current	Dimensions (mm)			Article No.
	( $\mu$ f)	(A)	H	W	D	
7.5	41.0	9.8	300	240	80	1HYC414012-107-1
10	54.8	13.1	300	240	80	1HYC414012-108-1
12.5	68.5	16.4	300	240	80	1HYC414012-109-1



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## Q cap L Box Type Capacitor Heavy Duty 440V

KVAR	Capacitance ( $\mu$ f)	Rated current (A)	Dimensions (mm)			Article No.
			H	W	D	
15	82.2	19.7	300	240	80	1HYC414012-110-1
20	109.7	26.2	300	240	160	1HYC414012-112-1
25	137.1	32.8	300	240	160	1HYC414012-114-1





## Q cap L Box Type Capacitor Heavy Duty 440V

### Cautions and warnings

- a. In case of dents or any other mechanical damage, capacitors must not be used at all.
- b. This applies also in case of oil leakages.
- c. To ensure the full functionality of the overpressure disconnecter, elastic elements must not be hindered and a minimum space of 12 mm has to be kept above each capacitor basic cell.
- d. Do not handle the capacitor before it is discharged.
- e. Resonance cases must be avoided by appropriate application design in any case.
- f. Handle capacitors carefully, because they may still be charged even after disconnection due to faulty discharging devices.
- g. Protect the capacitor properly against over current and short circuit.
- h. Failure to follow cautions may result, worst case, in premature failures, bursting and fire.

### Discharging

Capacitors must be discharged to a maximum of 10% of rated voltage before they are switched in again. This prevents an electric impulse discharge in the application, influences the capacitor's service life and protects against electric shock. The capacitor must be discharged to 50 V or less within 1 minute. There must be not any switch, fuse or any other disconnecting device in the circuit between the power capacitor and the discharging device. Discharge and short circuit capacitor before handling!

### Service life expectancy

Electrical components do not have an unlimited service life expectancy; this applies to self-healing capacitors too. The maximum service life expectancy may vary depending on the application the capacitor is used in.

### Safety

Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result from bursting of the capacitor or from expulsion of oil or melted material due to mechanical disruption of the capacitor.

- a. Ensure good, effective grounding for capacitor enclosures.
- b. Provide means of disconnecting and insulating a faulty component/bank.
- c. The terminals of capacitors, connected bus bars and cables as well as other devices may also be energized.
- d. Follow good engineering practice.

### Thermal load/over-temperature

After installation of the capacitor it is necessary to verify that maximum hot-spot temperature is not exceeded at extreme service conditions.

## Q cap L Box Type Capacitor Heavy Duty 440V

### Overpressure Disconnecter

To ensure full functionality of an overpressure disconnecter, the following must be observed:

1. The elastic elements must not be hindered.
2. Maximum allowed fault current of 10000 A in accordance with UL 810 standard must be assured by the application.
2. Stress parameters of the capacitor must be within the IEC60831/IS13340 specification.

### Overcurrent and short circuit protection

- Use HRC fuses or MCCBs for short circuit protection. Short circuit protection and connecting cables should be selected so that 1.5 times the rated capacitor current can be permanently handled.
- HRC fuses do not protect a capacitor against overload - they are only for short circuit protection.
- The HRC fuse rating should be 1.6 to 1.8 times rated capacitor current.
- Do not use HRC fuses to switch capacitors (risk of arcing).
- Use thermal magnetic over current relays for overload protection.

### Resonance cases

Resonance cases must be avoided by appropriate application design in any case. Maximum total RMS capacitor current (incl. fundamental harmonic current) specified in technical data must not be exceeded.

### Re-switching vs. phase-opposition

In case of voltage interruption, a sufficient discharge time has to be ensured to avoid phase-opposition and resulting high inrush currents.

### Vibration resistance

The resistance to vibration of capacitors corresponds to IEC 68, part 2–6.

Max. test conditions:

Test duration	6 h*
Frequency range 1	10 ... 55 Hz*
Displacement amplitude	0.75 mm*

\*corresponding to max. 98.1 m/s" or 10 g

These figures apply to the capacitor alone. Because the fixing and the terminals may influence the vibration properties, it is necessary to check stability when a capacitor is built in and exposed to vibration. Irrespective of this, you are advised not to locate capacitors where vibration amplitude reaches the maximum in strongly vibrating equipment.

### Mechanical protection

The capacitor has to be installed in a way that mechanical damages and dents are avoided.

## **Q cap L Box Type Capacitor Heavy Duty 440V**

### Grounding

The bolts of the capacitor top cover has to be used for grounding. In case grounding is done via metal chassis that the capacitor is mounted to, the layer of varnish beneath the washer and nut should be removed.

### Maintenance

- Check tightness of the connections/terminals periodically.
- Take current reading twice a year and compare with nominal current. Use a harmonic analyser or true effective RMS-meter.
- In case of current above the nominal current check your application for modifications.
- If a significant increase in the amount of non-linear loads has been detected, then a consultant has to be called in for a harmonic study.
- In case of the presence of harmonics installation of a de-tuned capacitor bank (reactors) must be considered.
- Check the temperature of capacitors directly after operation for a longer period, but make sure that the capacitors have been switched off. In case of excessive temperature of individual capacitors, it is recommended to replace these capacitors, as this should be an indication for loss factor increase, which is a sign for reaching end of life.

### Storage and operating conditions

Do not use or store capacitors in corrosive atmosphere, especially where chloride gas, sulphide gas, acid, alkali, salt or the like are present. In dusty environments regular maintenance and cleaning especially of the terminals is required to avoid conductive path between phases and/or phases and ground.

## Q cap L Box Type capacitor standard duty 440V

### Construction

- n Dielectric: Polypropylene film
- n Non PCB, Soft Polyurethane resin
- n Container type/finish: MS sheet metal / powder coated grey colour RAL-7310, Cable box- RAL 3020
- n Provided with discharge resistors
- n Overpressure disconnecter

### Features

- n Three phase, delta connected
- n Self-healing technology
- n Naturally air cooled (or forced air cooling)
- n Internal safety fuse
- n Provided with discharge resistor
- n Indoor mounting

### Typical applications

- n For Power Factor correction

### Terminals

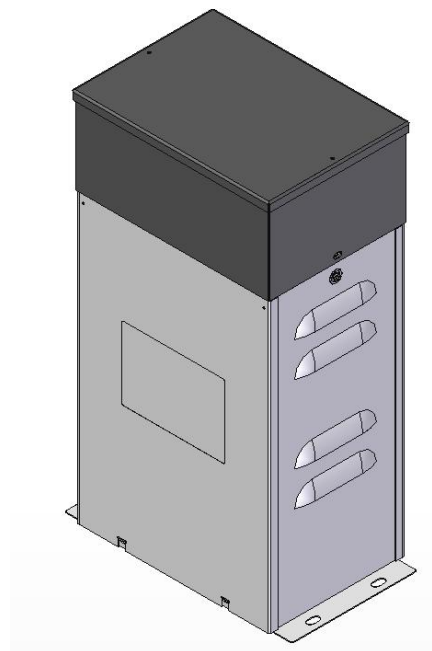
- n Cu Wire terminals – 1 to 6 KVAR
- n Stud terminals with ceramic bushing – 7.5 to 30 KVAR

### Mounting parts

- n Mounting Clamps at back – 1 to 6 KVAR
- n Mounting plates at top & bottom – 7.5 to 30 KVAR

### Technical data and specifications

Characteristics	
Rated capacitance $C_R$	As per table
Tolerance	0 / +10%
Connection	D (Delta)
Rated Voltage	As per table
Rated frequency $f_R$	50 Hz
Output	As per table
Rated current $I_R$	As per table
$\tan \delta_0$ (dielectric)	$\leq 0.2 \text{ W / kvar}$





## Q cap L Box Type capacitor standard duty 440V

### Maximum ratings

$V_{\max}$ (up to 8 h daily)	$(V_R + 10\% V_R) \text{ V AC}$
$V_{\max}$ (up to 1 min)	$(V_R + 30\% V_R) \text{ V AC}$
$I_{\max}$	$1.3 \cdot I_R \text{ (A)}$
$I_S$	$150 \cdot I_R \text{ (A)}$

### Test data

$V_{TT}$	$2.15 \cdot V_R, \text{ AC, 2s}$
$V_{TC}$	$3,600 \text{ V AC} / 50 \text{ Hz, 2s}$
* Losses (single phase cell)	$\leq 0.5 \text{ W} / \text{kvar}$

\* Without discharge resistor

### Climatic category / -10/D

$T_{\min}$	$-10 \text{ }^{\circ}\text{C}$
$T_{\max}$	$+55 \text{ }^{\circ}\text{C}$
Storage temperature	$-10 \text{ }^{\circ}\text{C}$ to $70 \text{ }^{\circ}\text{C}$
Hot Spot temperature	$70 \text{ }^{\circ}\text{C}$
Rel. humidity	max. 95%
Maximum altitude	4,000 m above sea level

### Mean life expectancy

$t_{LD}$	up to 100,000 hours
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Max. 5,000 switchings per year to IEC 60831

### Design data

Dimensions (H x W x D)	As per table
Impregnation	Biodegradable soft resin
Fixing	Mounting clamps or plates
Mounting position	Vertical position. See maintenance and installation manual for further details.

### Terminals

Metal top - 1 to 6 kvar	Cu wire
Metal top – 7.5 to 30 kvar	Studs with ceramic bushing



## Q cap L Box Type capacitor standard duty 440V

### Safety

Mechanical safety	Overpressure disconnecter
Max. short circuit current	AFC: 10 kA
Discharge resistor time	≤ 1 min (50 V)

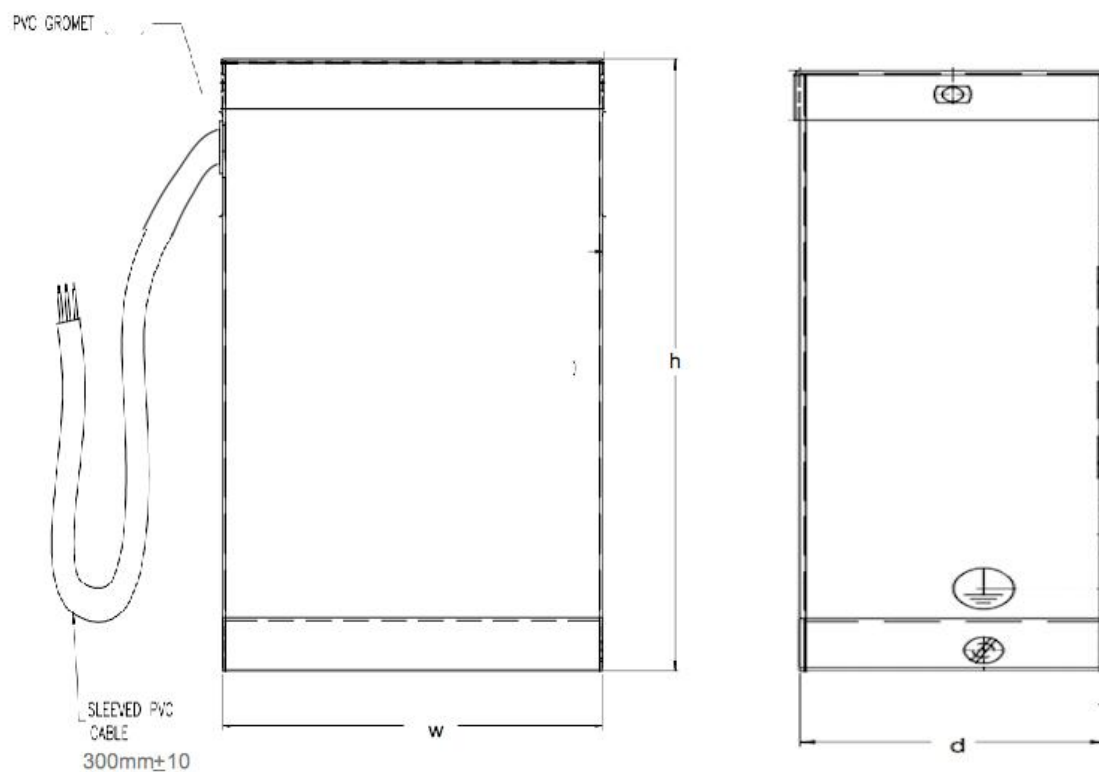
### Reference Standards

IS: 13340/41

IEC 60831 - 1&2

### Ordering Codes & Dimensional drawing:

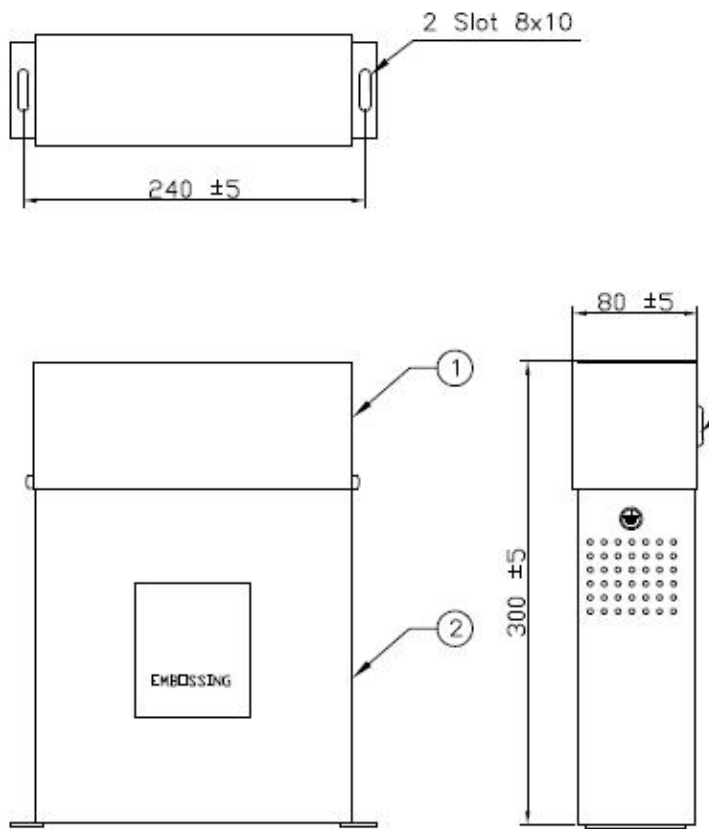
Power (Q) kvar	Capacitance ( $\mu$ f)	Rated current (A)	Dimensions (mm)			Cat. No.
			50 Hz	H	W	D
1.0	5.5	1.3	175	60	60	
2.0	11.0	2.6	175	60	60	
3.0	16.4	3.9	200	75	75	
4.0	21.9	5.3	200	75	75	
5.0	27.4	6.6	200	75	75	
6.0	32.9	8.0	200	75	75	



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## Q cap L Box Type capacitor standard duty 440V

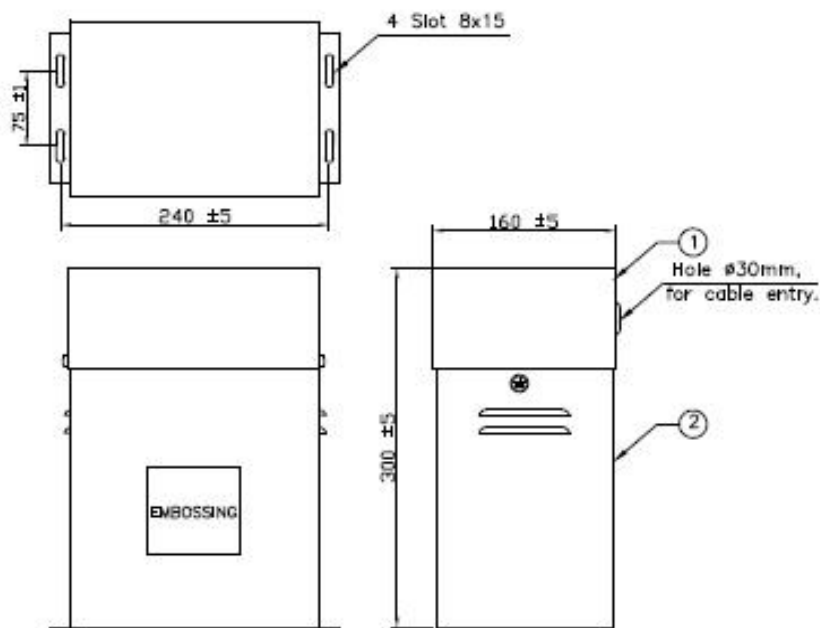
Power (Q) kvar	Capacitance ( $\mu$ f)	Rated current (A)	Dimensions (mm)			Cat. No.
50 Hz		50 Hz	H	W	D	
7.5	41.0	9.8	300	240	80	
8.33	45.7	10.9	300	240	80	
10	54.8	13.1	300	240	80	
12.5	68.5	16.4	300	240	80	
15	82.2	19.7	300	240	80	



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## Q cap L Box Type capacitor standard duty 440V

Power (Q) kvar	Capacitance ( $\mu$ f)	Rated current (A)	Dimensions (mm)			Cat. No.
50 Hz		50 Hz	H	W	D	
17.5	96.0	22.9	300	240	160	
20	109.7	26.2	300	240	160	
22.5	123.4	29.5	300	240	160	
25	137.1	32.8	300	240	160	
27.5	150.8	36.0	300	240	160	
30	164.5	39.4	300	240	160	





## Q cap L Box Type capacitor standard duty 440V

### Cautions and warnings

- c. In case of dents or any other mechanical damage, capacitors must not be used at all.
- d. This applies also in case of oil leakages.
- e. To ensure the full functionality of the overpressure disconnecter, elastic elements must not be hindered and a minimum space of 12 mm has to be kept above each capacitor basic cell.
- f. Do not handle the capacitor before it is discharged.
- g. Resonance cases must be avoided by appropriate application design in any case.
- h. Handle capacitors carefully, because they may still be charged even after disconnection due to faulty discharging devices.
- i. Protect the capacitor properly against over current and short circuit.
- j. Failure to follow cautions may result, worst case, in premature failures, bursting and fire.

### Discharging

Capacitors must be discharged to a maximum of 10% of rated voltage before they are switched in again. This prevents an electric impulse discharge in the application, influences the capacitor's service life and protects against electric shock. The capacitor must be discharged to 50 V or less within 1 minute. There must be not any switch, fuse or any other disconnecting device in the circuit between the power capacitor and the discharging device. Discharge and short circuit capacitor before handling!

### Service life expectancy

Electrical components do not have an unlimited service life expectancy; this applies to self-healing capacitors too. The maximum service life expectancy may vary depending on the application the capacitor is used in.

### Safety

Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result from bursting of the capacitor or from expulsion of oil or melted material due to mechanical disruption of the capacitor.

- e. Ensure good, effective grounding for capacitor enclosures.
- f. Provide means of disconnecting and insulating a faulty component/bank.
- g. The terminals of capacitors, connected bus bars and cables as well as other devices may also be energized.
- h. Follow good engineering practice.

### Thermal load/over-temperature

After installation of the capacitor it is necessary to verify that maximum hot-spot temperature is not exceeded at extreme service conditions.

## Q cap L Box Type capacitor standard duty 440V

### Overpressure Disconnecter

To ensure full functionality of an overpressure disconnecter, the following must be observed:

1. The elastic elements must not be hindered.
2. Maximum allowed fault current of 10000 A in accordance with UL 810 standard must be assured by the application.
2. Stress parameters of the capacitor must be within the IEC60831/IS13340 specification.

### Overcurrent and short circuit protection

- § Use HRC fuses or MCCBs for short circuit protection. Short circuit protection and connecting cables should be selected so that 1.5 times the rated capacitor current can be permanently handled.
- n HRC fuses do not protect a capacitor against overload - they are only for short circuit protection.
- n The HRC fuse rating should be 1.6 to 1.8 times rated capacitor current.
- n Do not use HRC fuses to switch capacitors (risk of arcing).
- n Use thermal magnetic over current relays for overload protection.

### Resonance cases

Resonance cases must be avoided by appropriate application design in any case. Maximum total RMS capacitor current (incl. fundamental harmonic current) specified in technical data must not be exceeded.

### Re-switching vs. phase-opposition

In case of voltage interruption, a sufficient discharge time has to be ensured to avoid phase-opposition and resulting high inrush currents.

### Vibration resistance

The resistance to vibration of capacitors corresponds to IEC 68, part 2–6.

Max. test conditions:

Test duration	6 h*
Frequency range 1	10 ... 55 Hz*
Displacement amplitude	0.75 mm*

\*corresponding to max. 98.1 m/s<sup>2</sup> or 10 g

These figures apply to the capacitor alone. Because the fixing and the terminals may influence the vibration properties, it is necessary to check stability when a capacitor is built in and exposed to vibration. Irrespective of this, you are advised not to locate capacitors where vibration amplitude reaches the maximum in strongly vibrating equipment.

### Mechanical protection

The capacitor has to be installed in a way that mechanical damages and dents are avoided.

## Q cap L Box Type capacitor standard duty 440V

### Grounding

The bolts of the capacitor top cover has to be used for grounding. In case grounding is done via metal chassis that the capacitor is mounted to, the layer of varnish beneath the washer and nut should be removed.

### Maintenance

- n Check tightness of the connections/terminals periodically.
- n Take current reading twice a year and compare with nominal current. Use a harmonic analyser or true effective RMS-meter.
- n In case of current above the nominal current check your application for modifications.
- n If a significant increase in the amount of non-linear loads has been detected, then a consultant has to be called in for a harmonic study.
- n In case of the presence of harmonics installation of a de-tuned capacitor bank (reactors) must be considered.
- n Check the temperature of capacitors directly after operation for a longer period, but make sure that the capacitors have been switched off. In case of excessive temperature of individual capacitors, it is recommended to replace these capacitors, as this should be an indication for loss factor increase, which is a sign for reaching end of life.

### Storage and operating conditions

Do not use or store capacitors in corrosive atmosphere, especially where chloride gas, sulphide gas, acid, alkali, salt or the like are present. In dusty environments regular maintenance and cleaning especially of the terminals is required to avoid conductive path between phases and/or phases and ground.

## Qcap L Cylindrical Capacitor Normal Duty 440V

### Construction

- n Dielectric: Polypropylene film
- n Non PCB, Soft Polyurethane resin
- n Extruded round aluminium can with stud
- n Provided with discharge resistors
- n Overpressure disconnecter

### Features

- n Three phase, delta connected
- n Self-healing technology
- n Naturally air cooled (or forced air cooling)
- n Internal safety fuse
- n Provided with discharge resistor
- n Indoor mounting

### Typical applications

- n For Power Factor correction

### Terminals

- n Cu Wire terminals for metal top -1 to 6 kvar
- n Screw terminal for metal top – 7.5 to 30 kvar

### Mounting parts

Threaded stud at bottom of can  
(max. torque = 4Nm for M8 & 10Nm for M12 )

### Technical data and specifications

Characteristics	
Rated capacitance $C_R$	As per table
Tolerance	-0 / +10%
Connection	D (Delta)
Rated Voltage	As per table
Rated frequency $f_R$	50 Hz
Output	As per table
Rated current $I_R$	As per table
$\tan \delta_0$ (dielectric)	$\leq 0.2 \text{ W / kvar}$

Maximum ratings	
$V_{\max}$ (up to 8 h daily)	$(V_R + 10\% V_R) \text{ V AC}$
$V_{\max}$ (up to 1 min)	$(V_R + 30\% V_R) \text{ V AC}$
$I_{\max}$	$1.3 * I_R \text{ (A)}$
$I_S$	$150 * I_R \text{ (A)}$



## Qcap L Cylindrical Capacitor Normal Duty 440V

Test data	
$V_{TT}$	2.15* $V_R$ , AC, 2s
$V_{TC}$	3,600 V AC / 50 Hz, 2 s
* Losses	$\leq 0.5$ W / kvar

\* Without discharge resistor

Climatic category / -10/D	
$T_{min}$	-10 °C
$T_{max}$	+55 °C
Storage temperature	-10 °C to 70 °C
Hot Spot temperature	70 °C
Rel. humidity	max. 95%
Maximum altitude	4,000 m above sea level

Mean life expectancy	
$t_{LD}$	up to 100,000 hours
Max. 5,000 switchings per year to IEC 60831	

Design data	
Dimensions (d xh)	As per table
Impregnation	Biodegradable soft resin
Fixing	Threaded bolt M12 for case size dia > 50mm M8 for case size dia $\leq$ 50mm
Mounting position	Vertical position. See maintenance & installation manual for further details.

Terminals	
Metal top -1 to 6 kvar	Cu wire
Metal top – 7.5 to 30 kvar	Finger proof terminal
Finger proof terminals	
Degree of protection	Isolated terminals, IP20
Max. torque	1.2 Nm
Cable cross section	Max. 16 mm <sup>2</sup>
Maximum terminal current	50 A
Creepage distance	12.7 mm
Clearance	9.6 mm

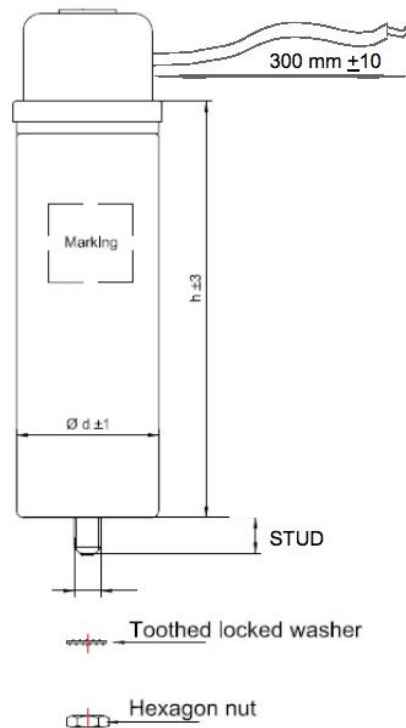
## Qcap L Cylindrical Capacitor Normal Duty 440V

Safety	
Mechanical safety	Overpressure disconnecter
Max. short circuit current	AFC: 10 kA
Discharge resistor time	$\leq 1$ min (50 V)

Reference Standards
IS: 13340/41
IEC 60831-1&2

### Ordering Codes & Dimensional Drawings:

KVAR	Capacitance uF	Rated Current (A)	Dimensions (mm)		Ordering Code
			d	h	
1.0	5.5	1.3	50	105	
2.0	11.0	2.6	50	125	
3.0	16.4	3.9	50	150	
4.0	21.9	5.3	63.5	128	
5.0	27.4	6.6	63.5	150	
6.0	32.9	8.0	63.5	150	

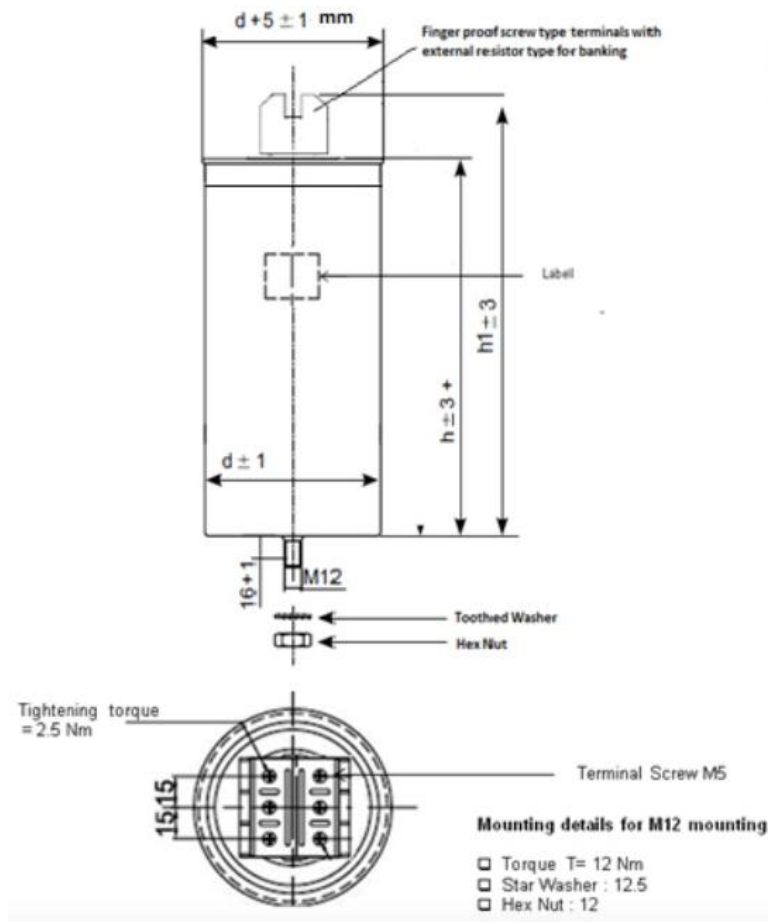


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## Qcap L Cylindrical Capacitor Normal Duty 440V

KVAR	Capacitance uF	Rated Current (A)	Dimensions (mm)		Ordering Code
			d	h	
7.5	41.0	9.8	75	197	
8.33	45.7	10.9	75	197	
10	54.8	13.1	85	197	
12.5	68.5	16.4	85	272	
15	82.2	19.7	85	272	
17.5	96.0	22.9	90	272	
20	109.7	26.2	85	354	
22.5	123.4	29.5	85	354	
25	137.1	32.8	90	354	
27.5	150.8	36.0	100	354	
30	164.5	39.4	100	354	

\*  $h_1 = h + 40\text{mm} \pm 3$



## Qcap L Cylindrical Capacitor Normal Duty 440V

### Cautions and warnings

- § In case of dents or any other mechanical damage, capacitors must not be used at all.
- § This applies also in case of resin leakages.
- § To ensure the full functionality of the overpressure disconnecter, elastic elements must not be hindered and a minimum space of 12 mm has to be kept above each capacitor basic cell.
- § Do not handle the capacitor before it is discharged.
- § Resonance cases must be avoided by appropriate application design in any case.
- § Handle capacitors carefully, because they may still be charged even after disconnection due to faulty discharging devices.
- § Protect the capacitor properly against over current and short circuit.
- § Failure to follow cautions may result, worst case, in premature failures, bursting and fire.

### Discharging

Capacitors must be discharged to a maximum of 10% of rated voltage before they are switched in again. This prevents an electric impulse discharge in the application, influences the capacitor's service life and protects against electric shock. The capacitor must be discharged to 50 V or less within 1 minute. There must not be any switch, fuse or any other disconnecting device in the circuit between the power capacitor and the discharging device. Discharge and short circuit capacitor before handling!

### Service life expectancy

Electrical components do not have an unlimited service life expectancy; this applies to self-healing capacitors too. The maximum service life expectancy may vary depending on the application the capacitor is used in.

### Safety

Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result from bursting of the capacitor or from expulsion of resin or melted material due to mechanical disruption of the capacitor.

- § Ensure good, effective grounding for capacitor enclosures.
- § Provide means of disconnecting and insulating a faulty component/bank.
- § The terminals of capacitors, connected bus bars and cables as well as other devices may also be energized.
- § Follow good engineering practice.

### Thermal load/over-temperature

After installation of the capacitor it is necessary to verify that maximum hot-spot temperature is not exceeded at extreme service conditions.



## Qcap L Cylindrical Capacitor Normal Duty 440V

### Overpressure Disconnecter

To ensure full functionality of an overpressure disconnecter, the following must be observed:

1. The elastic elements must not be hindered.
2. Maximum allowed fault current of 10000 A must be assured by the application.
2. Stress parameters of the capacitor must be within the IEC60831/IS13340 specification.

### Overcurrent and short circuit protection

- § Use HRC fuses or MCCBs for short circuit protection. Short circuit protection and connecting cables should be selected so that 1.5 times the rated capacitor current can be permanently handled.
- § HRC fuses do not protect a capacitor against overload - they are only for short circuit protection.
- § The HRC fuse rating should be 1.6 to 1.8 times rated capacitor current.
- § Do not use HRC fuses to switch capacitors (risk of arcing).
- § Use thermal magnetic over current relays for overload protection.

### Resonance cases

Resonance cases must be avoided by appropriate application design in any case. Maximum total RMS capacitor current (incl. fundamental harmonic current) specified in technical data must not be exceeded.

### Re-switching vs. phase-opposition

In case of voltage interruption, a sufficient discharge time has to be ensured to avoid phase-opposition and resulting high inrush currents.

### Vibration resistance

The resistance to vibration of capacitors corresponds to IEC 68, part 2–6.

Max. test conditions:

Test duration	6 h*
Frequency range 1	10 ... 55 Hz*
Displacement amplitude	0.75 mm*

\*corresponding to max. 98.1 m/s" or 10 g

These figures apply to the capacitor alone. Because the fixing and the terminals may influence the vibration properties, it is necessary to check stability when a capacitor is built in and exposed to vibration. Irrespective of this, you are advised not to locate capacitors where vibration amplitude reaches the maximum in strongly vibrating equipment.

### Mechanical protection

The capacitor has to be installed in a way that mechanical damages and dents in the aluminum can be avoided.

## Qcap L Cylindrical Capacitor Normal Duty 440V

### Grounding

The threaded bottom stud of the capacitor has to be used for grounding. In case grounding is done via metal chassis that the capacitor is mounted to, the layer of varnish beneath the washer and nut should be removed. The maximum tightening torque is 10 Nm for M12 stud and 4Nm for M8 stud.

### Maintenance

- § Check tightness of the connections/terminals periodically.
- § Take current reading twice a year and compare with nominal current. Use a harmonic analyser or true effective RMS-meter.
- § In case of current above the nominal current check your application for modifications.
- § If a significant increase in the amount of non-linear loads has been detected, then a consultant has to be called in for a harmonic study.
- § In case of the presence of harmonics installation of a de-tuned capacitor bank (reactors) must be considered.
- § Check the temperature of capacitors directly after operation for a longer period, but make sure that the capacitors have been switched off. In case of excessive temperature of individual capacitors, it is recommended to replace these capacitors, as this should be an indication for loss factor increase, which is a sign for reaching end of life.

### Storage and operating conditions

Do not use or store capacitors in corrosive atmosphere, especially where chloride gas, sulphide gas, acid, alkali, salt or the like are present. In dusty environments regular maintenance and cleaning especially of the terminals is required to avoid conductive path between phases and/or phases and ground.

## Qcap L Cylindrical Capacitor Normal Duty 480V

### Construction

- n Dielectric: Polypropylene film
- n Non PCB, Soft Polyurethane resin
- n Extruded round aluminium can with stud
- n Provided with discharge resistors
- n Overpressure disconnecter

### Features

- n Three phase, delta connected
- n Self-healing technology
- n Naturally air cooled (or forced air cooling)
- n Internal safety fuse
- n Provided with discharge resistor
- n Indoor mounting

### Typical applications

- n For Power Factor correction

### Terminals

- n Cu Wire terminals for metal top -1 to 6 kvar
- n Screw terminal for metal top – 7.5 to 30 kvar

### Mounting parts

Threaded stud at bottom of can  
(max. torque = 4Nm for M8 & 10Nm for M12 )

### Technical data and specifications

Characteristics	
Rated capacitance $C_R$	As per table
Tolerance	-0 / +10%
Connection	D (Delta)
Rated Voltage	As per table
Rated frequency $f_R$	50 Hz
Output	As per table
Rated current $I_R$	As per table
$\tan \delta_0$ (dielectric)	$\leq 0.2 \text{ W / kvar}$

Maximum ratings	
$V_{\max}$ (up to 8 h daily)	$(V_R + 10\% V_R) \text{ V AC}$
$V_{\max}$ (up to 1 min)	$(V_R + 30\% V_R) \text{ V AC}$
$I_{\max}$	$1.3 * I_R \text{ (A)}$
$I_s$	$150 * I_R \text{ (A)}$



## Qcap L Cylindrical Capacitor Normal Duty 480V

### Test data

$V_{TT}$	2.15* $V_R$ , AC, 2s
$V_{TC}$	3,600 V AC / 50 Hz, 2 s
* Losses	$\leq 0.5$ W / kvar

\* Without discharge resistor

### Climatic category / -10/D

$T_{min}$	-10 °C
$T_{max}$	+55 °C
Storage temperature	-10 °C to 70 °C
Hot Spot temperature	70 °C
Rel. humidity	max. 95%
Maximum altitude	4,000 m above sea level

### Mean life expectancy

$t_{LD}$	up to 100,000 hours
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Max. 5,000 switchings per year to IEC 60831

### Design data

Dimensions (d x h)	As per table
Impregnation	Biodegradable soft resin
Fixing	Threaded bolt M12 for case size dia > 50mm M8 for case size dia $\leq$ 50mm
Mounting position	Vertical position. See maintenance & installation manual for further details.

### Terminals

Metal top -1 to 6 kvar	Cu wire
Metal top – 7.5 to 30 kvar	Finger proof terminal
Finger proof terminals	
Degree of protection	Isolated terminals, IP20
Max. torque	1.2 Nm
Cable cross section	Max. 16 mm <sup>2</sup>
Maximum terminal current	50 A
Creepage distance	12.7 mm
Clearance	9.6 mm

# ABB

## Qcap L Cylindrical Capacitor Normal Duty 480V

### Safety

Mechanical safety	Overpressure disconnecter
Max. short circuit current	AFC: 10 kA
Discharge resistor time	$\leq 1$ min (50 V)

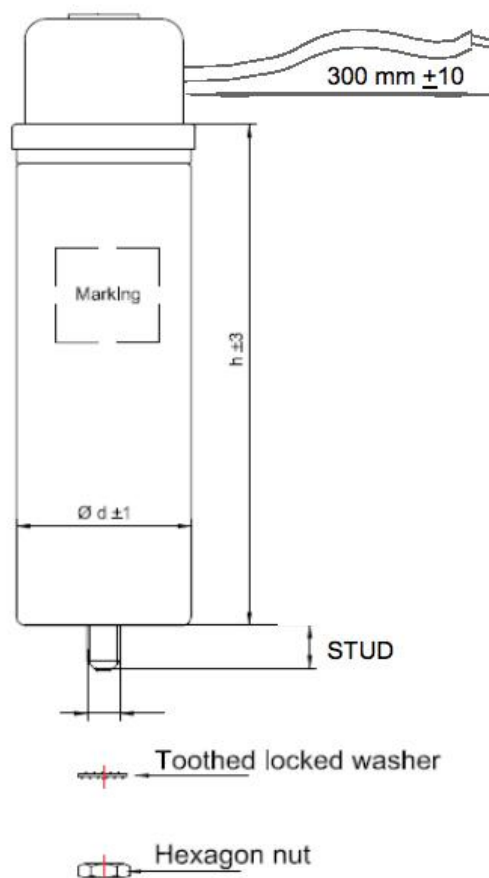
### Reference Standards

IS: 13340/41

IEC 60831-1&2

### Ordering Codes & Dimensional Drawings:

KVAR	Capacitance (uF)	Rated Current (A)	Dimensions (mm)		Stud Length (mm)	Stud Type	Ordering Code / Article No.
			d	h			
5.5	25.4	6.6	63.5	150	16	M12	1HYC414014-101-1

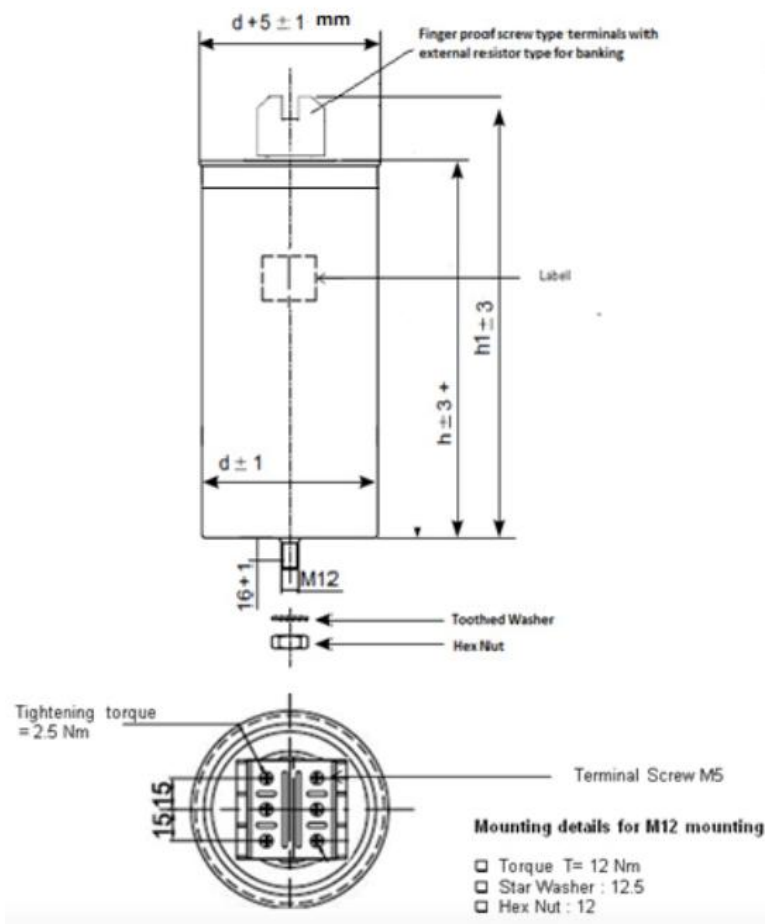


# ABB

## Qcap L Cylindrical Capacitor Normal Duty 480V

KVAR	Capacitance (uF)	Rated Current (A)	Dimensions (mm)		Stud Length (mm)	Stud Type	Ordering Code / Article No.
			d	h			
8.3	38.3	10.0	75	154	16	M12	1HYC414014-102-1
11.1	51.2	13.3	85	197	16	M12	1HYC414014-104-1
12.5	57.6	15.0	85	197	16	M12	1HYC414014-105-1
15	69.2	18.0	85	272	16	M12	1HYC414014-107-1
16.6	76.5	20.0	85	272	16	M12	1HYC414014-108-1
20.8	95.9	25.0	90	272	16	M12	1HYC414014-109-1
22.1	101.9	26.5	90	272	16	M12	1HYC414014-110-1
25	115.3	30.0	100	272	16	M12	1HYC414014-111-1
27.7	127.7	33.2	100	272	16	M12	1HYC414014-112-1
30	138.3	36.0	100	272	16	M12	1HYC414014-113-1

\*  $h_1 = h + 40\text{mm} \pm 3$



## Qcap L Cylindrical Capacitor Normal Duty 480V

### Cautions and warnings

- § In case of dents or any other mechanical damage, capacitors must not be used at all.
- § This applies also in case of oil leakages.
- § To ensure the full functionality of the overpressure disconnecter, elastic elements must not be hindered and a minimum space of 12 mm has to be kept above each capacitor basic cell.
- § Do not handle the capacitor before it is discharged.
- § Resonance cases must be avoided by appropriate application design in any case.
- § Handle capacitors carefully, because they may still be charged even after disconnection due to faulty discharging devices.
- § Protect the capacitor properly against over current and short circuit.
- § Failure to follow cautions may result, worst case, in premature failures, bursting and fire.

### Discharging

Capacitors must be discharged to a maximum of 10% of rated voltage before they are switched in again. This prevents an electric impulse discharge in the application, influences the capacitor's service life and protects against electric shock. The capacitor must be discharged to 50 V or less within 1 minute. There must be not any switch, fuse or any other disconnecting device in the circuit between the power capacitor and the discharging device. Discharge and short circuit capacitor before handling!

### Service life expectancy

Electrical components do not have an unlimited service life expectancy; this applies to self-healing capacitors too. The maximum service life expectancy may vary depending on the application the capacitor is used in.

### Safety

Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result from bursting of the capacitor or from expulsion of oil or melted material due to mechanical disruption of the capacitor.

- § Ensure good, effective grounding for capacitor enclosures.
- § Provide means of disconnecting and insulating a faulty component/bank.
- § The terminals of capacitors, connected bus bars and cables as well as other devices may also be energized.
- § Follow good engineering practice.

### Thermal load/over-temperature

After installation of the capacitor it is necessary to verify that maximum hot-spot temperature is not exceeded at extreme service conditions.

## Qcap L Cylindrical Capacitor Normal Duty 480V

### Overpressure Disconnecter

To ensure full functionality of an overpressure disconnecter, the following must be observed:

1. The elastic elements must not be hindered.
2. Maximum allowed fault current of 10000 A in accordance with UL 810 standard must be assured by the application.
2. Stress parameters of the capacitor must be within the IEC60831/IS13340 specification.

### Overcurrent and short circuit protection

- § Use HRC fuses or MCCBs for short circuit protection. Short circuit protection and connecting cables should be selected so that 1.5 times the rated capacitor current can be permanently handled.
- § HRC fuses do not protect a capacitor against overload - they are only for short circuit protection.
- § The HRC fuse rating should be 1.6 to 1.8 times rated capacitor current.
- § Do not use HRC fuses to switch capacitors (risk of arcing).
- § Use thermal magnetic over current relays for overload protection.

### Resonance cases

Resonance cases must be avoided by appropriate application design in any case. Maximum total RMS capacitor current (incl. fundamental harmonic current) specified in technical data must not be exceeded.

### Re-switching vs. phase-opposition

In case of voltage interruption, a sufficient discharge time has to be ensured to avoid phase-opposition and resulting high inrush currents.

### Vibration resistance

The resistance to vibration of capacitors corresponds to IEC 68, part 2–6.

Max. test conditions:

Test duration	6 h*
Frequency range 1	10 ... 55 Hz*
Displacement amplitude	0.75 mm*

\*corresponding to max. 98.1 m/s" or 10 g

These figures apply to the capacitor alone. Because the fixing and the terminals may influence the vibration properties, it is necessary to check stability when a capacitor is built in and exposed to vibration. Irrespective of this, you are advised not to locate capacitors where vibration amplitude reaches the maximum in strongly vibrating equipment.

### Mechanical protection

The capacitor has to be installed in a way that mechanical damages and dents in the aluminum can are avoided.



## **Qcap L Cylindrical Capacitor Normal Duty 480V**

### Grounding

The threaded bottom stud of the capacitor has to be used for grounding. In case grounding is done via metal chassis that the capacitor is mounted to, the layer of varnish beneath the washer and nut should be removed. The maximum tightening torque is 10 Nm for M12 stud and 4Nm for M8 stud.

### Maintenance

- § Check tightness of the connections/terminals periodically.
- § Take current reading twice a year and compare with nominal current. Use a harmonic analyser or true effective RMS-meter.
- § In case of current above the nominal current check your application for modifications.
- § If a significant increase in the amount of non-linear loads has been detected, then a consultant has to be called in for a harmonic study.
- § In case of the presence of harmonics installation of a de-tuned capacitor bank (reactors) must be considered.
- § Check the temperature of capacitors directly after operation for a longer period, but make sure that the capacitors have been switched off. In case of excessive temperature of individual capacitors, it is recommended to replace these capacitors, as this should be an indication for loss factor increase, which is a sign for reaching end of life.

### Storage and operating conditions

Do not use or store capacitors in corrosive atmosphere, especially where chloride gas, sulphide gas, acid, alkali, salt or the like are present. In dusty environments regular maintenance and cleaning especially of the terminals is required to avoid conductive path between phases and/or phases and ground.

## Qcap L Cylindrical Capacitor Normal Duty 525V

### Construction

- n Dielectric: Polypropylene film
- n Non PCB, Soft Polyurethane resin
- n Extruded round aluminium can with stud
- n Provided with discharge resistors
- n Overpressure disconnecter

### Features

- n Three phase, delta connected
- n Self-healing technology
- n Naturally air cooled (or forced air cooling)
- n Internal safety fuse
- n Provided with discharge resistor
- n Indoor mounting

### Typical applications

- n For Power Factor correction

### Terminals

- n Cu Wire terminals for metal top -1 to 5 kvar
- n Screw terminal for metal top – 6.3 to 30 kvar

### Mounting parts

Threaded stud at bottom of can  
(max. torque = 4Nm for M8 & 10Nm for M12 )

### Technical data and specifications

Characteristics	
Rated capacitance $C_R$	As per table
Tolerance	-0 / +10%
Connection	D (Delta)
Rated Voltage	As per table
Rated frequency $f_R$	50 Hz
Output	As per table
Rated current $I_R$	As per table
$\tan \delta_0$ (dielectric)	$\leq 0.2 \text{ W / kvar}$

Maximum ratings	
$V_{\max}$ (up to 8 h daily)	$(V_R + 10\% V_R) \text{ V AC}$
$V_{\max}$ (up to 1 min)	$(V_R + 30\% V_R) \text{ V AC}$
$I_{\max}$	$1.3 * I_R \text{ (A)}$
$I_s$	$150 * I_R \text{ (A)}$



## Qcap L Cylindrical Capacitor Normal Duty 525V

### Test data

$V_{TT}$	2.15* $V_R$ , AC, 2s
$V_{TC}$	3,600 V AC / 50 Hz, 2 s
* Losses	$\leq 0.5$ W / kvar

\* Without discharge resistor

### Climatic category / -10/D

$T_{min}$	-10 °C
$T_{max}$	+55 °C
Storage temperature	-10 °C to 70 °C
Hot Spot temperature	70 °C
Rel. humidity	max. 95%
Maximum altitude	4,000 m above sea level

### Mean life expectancy

$t_{LD}$	up to 100,000 hours
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Max. 5,000 switchings per year to IEC 60831

### Design data

Dimensions (d x h)	As per table
Impregnation	Biodegradable soft resin
Fixing	Threaded bolt M12 for case size dia > 50mm M8 for case size dia $\leq$ 50mm
Mounting position	Vertical position. See maintenance & installation manual for further details.

### Terminals

Metal top -1 to 6 kvar	Cu wire
Metal top – 7.5 to 30 kvar	Finger proof terminal
Finger proof terminals	
Degree of protection	Isolated terminals, IP20
Max. torque	1.2 Nm
Cable cross section	Max. 16 mm <sup>2</sup>
Maximum terminal current	50 A
Creepage distance	12.7 mm
Clearance	9.6 mm

## Qcap L Cylindrical Capacitor Normal Duty 525V

### Safety

Mechanical safety	Overpressure disconnecter
Max. short circuit current	AFC: 10 kA
Discharge resistor time	$\leq 1$ min (50 V)

### Reference Standards

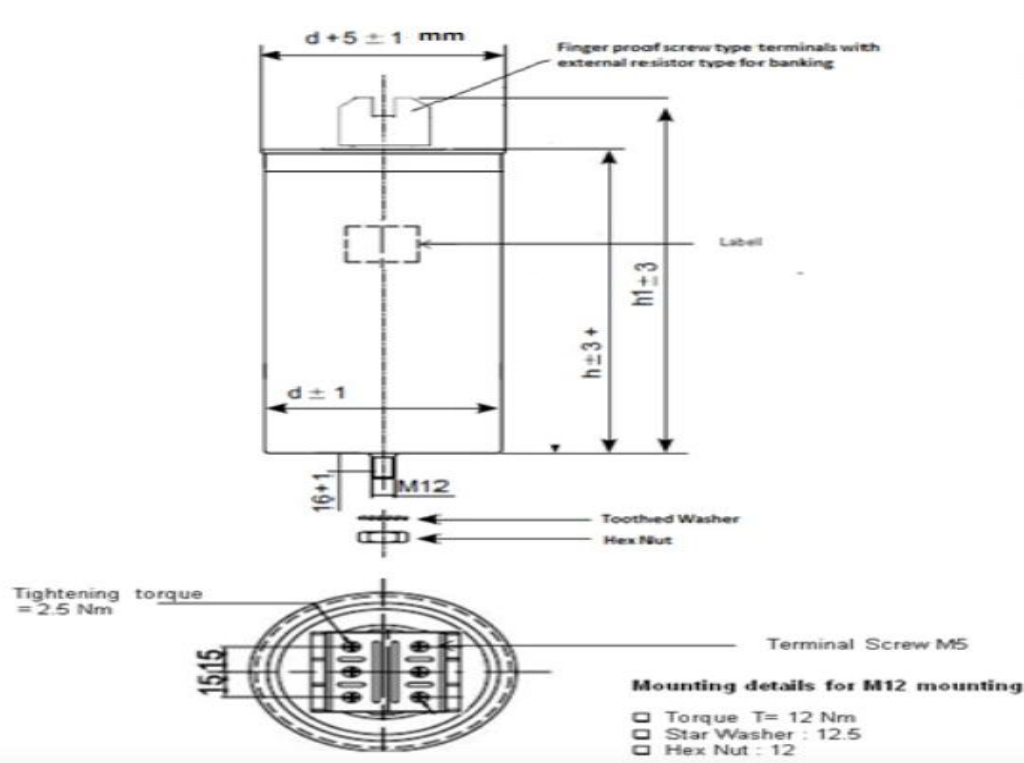
IS: 13340/41

IEC 60831-1&2

### Ordering Codes & Dimensional Drawings:

KVAR	Capacitance (uF)	Rated Current (A)	Dimensions (mm)		Stud Length (mm)	Stud Type	Ordering Code / Article No.
			d	h			
6.6	25.4	7.2	75	154	16	M12	1HYC414016-102-1
10.4	40.0	11.4	75	272	16	M12	1HYC414016-105-1
13.2	50.8	14.5	75	272	16	M12	1HYC414016-107-1
16.6	63.9	18.2	85	272	16	M12	1HYC414016-108-1
20.8	80.0	22.9	90	272	16	M12	1HYC414016-111-1
26.5	102.0	29.1	100	272	16	M12	1HYC414016-112-1
33.1	127.4	36.4	100	347	16	M12	1HYC414016-113-1

\* h1 = h + 40mm  $\pm 3$



## Qcap L Cylindrical Capacitor Normal Duty 525V

### Cautions and warnings

- § In case of dents or any other mechanical damage, capacitors must not be used at all.
- § This applies also in case of oil leakages.
- § To ensure the full functionality of the overpressure disconnecter, elastic elements must not be hindered and a minimum space of 12 mm has to be kept above each capacitor basic cell.
- § Do not handle the capacitor before it is discharged.
- § Resonance cases must be avoided by appropriate application design in any case.
- § Handle capacitors carefully, because they may still be charged even after disconnection due to faulty discharging devices.
- § Protect the capacitor properly against over current and short circuit.
- § Failure to follow cautions may result, worst case, in premature failures, bursting and fire.

### Discharging

Capacitors must be discharged to a maximum of 10% of rated voltage before they are switched in again. This prevents an electric impulse discharge in the application, influences the capacitor's service life and protects against electric shock. The capacitor must be discharged to 50 V or less within 1 minute. There must be not any switch, fuse or any other disconnecting device in the circuit between the power capacitor and the discharging device. Discharge and short circuit capacitor before handling!

### Service life expectancy

Electrical components do not have an unlimited service life expectancy; this applies to self-healing capacitors too. The maximum service life expectancy may vary depending on the application the capacitor is used in.

### Safety

Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result from bursting of the capacitor or from expulsion of oil or melted material due to mechanical disruption of the capacitor.

- § Ensure good, effective grounding for capacitor enclosures.
- § Provide means of disconnecting and insulating a faulty component/bank.
- § The terminals of capacitors, connected bus bars and cables as well as other devices may also be energized.
- § Follow good engineering practice.

### Thermal load/over-temperature

After installation of the capacitor it is necessary to verify that maximum hot-spot temperature is not exceeded at extreme service conditions.

## Qcap L Cylindrical Capacitor Normal Duty 525V

### Overpressure Disconnecter

To ensure full functionality of an overpressure disconnecter, the following must be observed:

1. The elastic elements must not be hindered.
2. Maximum allowed fault current of 10000 A in accordance with UL 810 standard must be assured by the application.
3. Stress parameters of the capacitor must be within the IEC60831/IS13340 specification.

### Overcurrent and short circuit protection

- § Use HRC fuses or MCCBs for short circuit protection. Short circuit protection and connecting cables should be selected so that 1.5 times the rated capacitor current can be permanently handled.
- § HRC fuses do not protect a capacitor against overload - they are only for short circuit protection.
- § The HRC fuse rating should be 1.6 to 1.8 times rated capacitor current.
- § Do not use HRC fuses to switch capacitors (risk of arcing).
- § Use thermal magnetic over current relays for overload protection.

### Resonance cases

Resonance cases must be avoided by appropriate application design in any case. Maximum total RMS capacitor current (incl. fundamental harmonic current) specified in technical data must not be exceeded.

### Re-switching vs. phase-opposition

In case of voltage interruption, a sufficient discharge time has to be ensured to avoid phase-opposition and resulting high inrush currents.

### Vibration resistance

The resistance to vibration of capacitors corresponds to IEC 68, part 2–6.

Max. test conditions:

Test duration	6 h*
Frequency range 1	10 ... 55 Hz*
Displacement amplitude	0.75 mm*

\*corresponding to max. 98.1 m/s" or 10 g

These figures apply to the capacitor alone. Because the fixing and the terminals may influence the vibration properties, it is necessary to check stability when a capacitor is built in and exposed to vibration. Irrespective of this, you are advised not to locate capacitors where vibration amplitude reaches the maximum in strongly vibrating equipment.

### Mechanical protection

The capacitor has to be installed in a way that mechanical damages and dents in the aluminum can are avoided.

## **Qcap L Cylindrical Capacitor Normal Duty 525V**

### Grounding

The threaded bottom stud of the capacitor has to be used for grounding. In case grounding is done via metal chassis that the capacitor is mounted to, the layer of varnish beneath the washer and nut should be removed. The maximum tightening torque is 10 Nm for M12 stud and 4Nm for M8 stud.

### Maintenance

- § Check tightness of the connections/terminals periodically.
- § Take current reading twice a year and compare with nominal current. Use a harmonic analyser or true effective RMS-meter.
- § In case of current above the nominal current check your application for modifications.
- § If a significant increase in the amount of non-linear loads has been detected, then a consultant has to be called in for a harmonic study.
- § In case of the presence of harmonics installation of a de-tuned capacitor bank (reactors) must be considered.
- § Check the temperature of capacitors directly after operation for a longer period, but make sure that the capacitors have been switched off. In case of excessive temperature of individual capacitors, it is recommended to replace these capacitors, as this should be an indication for loss factor increase, which is a sign for reaching end of life.

### Storage and operating conditions

Do not use or store capacitors in corrosive atmosphere, especially where chloride gas, sulphide gas, acid, alkali, salt or the like are present. In dusty environments regular maintenance and cleaning especially of the terminals is required to avoid conductive path between phases and/or phases and ground.

## Q cap L Cylindrical Capacitor Heavy Duty 440V

### Construction

- n Dielectric: Polypropylene film
- n Non PCB, Soft Polyurethane resin
- n Extruded round aluminium can with stud
- n Provided with discharge resistors
- n Overpressure disconnecter

### Features

- n Three phase, delta connected
- n Self-healing technology
- n Naturally air cooled (or forced air cooling)
- n Internal safety fuse
- n Provided with discharge resistor
- n Indoor mounting

### Typical applications

- n For Power Factor correction

### Terminals

- n Cu Wire terminals for metal top - 1 to 4 kvar
- n Screw terminal for metal top – 5 to 30 kvar

### Mounting parts

Threaded stud at bottom of can  
(max. torque = 4Nm for M8 & 10Nm for M12 )

### Technical data and specifications

Characteristics	
Rated capacitance $C_R$	As per table
Tolerance	-0 / +10%
Connection	D (Delta)
Rated Voltage	As per table
Rated frequency $f_R$	50 Hz
Output	As per table
Rated current $I_R$	As per table
$\tan \delta_0$ (dielectric)	$\leq 0.2 \text{ W / kvar}$





## Q cap L Cylindrical Capacitor Heavy Duty 440V

Maximum ratings	
$V_{\max}$ (up to 8 h daily)	$(V_R + 10\% V_R) \text{ V AC}$
$V_{\max}$ (up to 1 min)	$(V_R + 30\% V_R) \text{ V AC}$
$I_{\max}$	$1.5 * I_R \text{ (A)}$
$I_S$	$250 * I_R \text{ (A)}$

Test data	
$V_{TT}$	$2.15 * V_R, \text{ AC}, 2\text{s}$
$V_{TC}$	$3,600 \text{ V AC} / 50 \text{ Hz}, 2 \text{ s}$
* Losses	$\leq 0.5 \text{ W} / \text{kvar}$

\* Without discharge resistor

Climatic category / -10/D	
$T_{\min}$	$-10 \text{ }^{\circ}\text{C}$
$T_{\max}$	$+55 \text{ }^{\circ}\text{C}$
Storage temperature	$-10 \text{ }^{\circ}\text{C}$ to $70 \text{ }^{\circ}\text{C}$
Hot Spot temperature	$70 \text{ }^{\circ}\text{C}$
Rel. humidity	max. 95%
Maximum altitude	4,000 m above sea level

Mean life expectancy	
$t_{LD}$	up to 115,000 hours
Max. 6,000 switchings per year to IEC 60831	

Design data	
Dimensions (d x h)	As per table
Impregnation	Biodegradable soft resin
Fixing	Threaded bolt M12 for case size dia > 50mm M8 for case size dia $\leq$ 50mm
Mounting position	Vertical position. See maintenance & installation manual for further details.



## Q cap L Cylindrical Capacitor Heavy Duty 440V

Terminals	
Metal top -1 to 4 kvar	Cu wire
Metal top – 5 to 30 kvar	Finger proof terminal
Finger proof terminals	
Degree of protection	Isolated terminals, IP20
Max. torque	1.2 Nm
Cable cross section	Max. 16 mm <sup>2</sup>
Maximum terminal current	50 A
Creepage distance	12.7 mm
Clearance	9.6 mm

Safety	
Mechanical safety	Overpressure disconnecter
Max. short circuit current	AFC: 10 kA
Discharge resistor time	≤ 1 min (50 V)

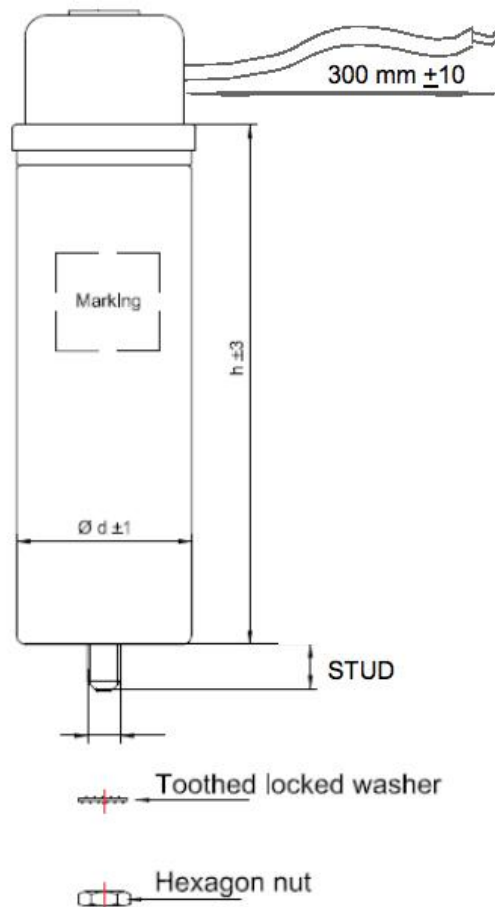
Reference Standards	
IS: 13340/41	
IEC 60831-1&2	

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## Q cap L Cylindrical Capacitor Heavy Duty 440V

### Ordering Codes & Dimensional Drawings:

KVAR	Capacitance uF	Rated Current (A)	Dimensions (mm)	
			d	h
1.0	5.5	1.3	50	125
2.0	11.0	2.6	63.5	128
3.0	16.4	3.9	63.5	128
4.0	21.9	5.3	63.5	150

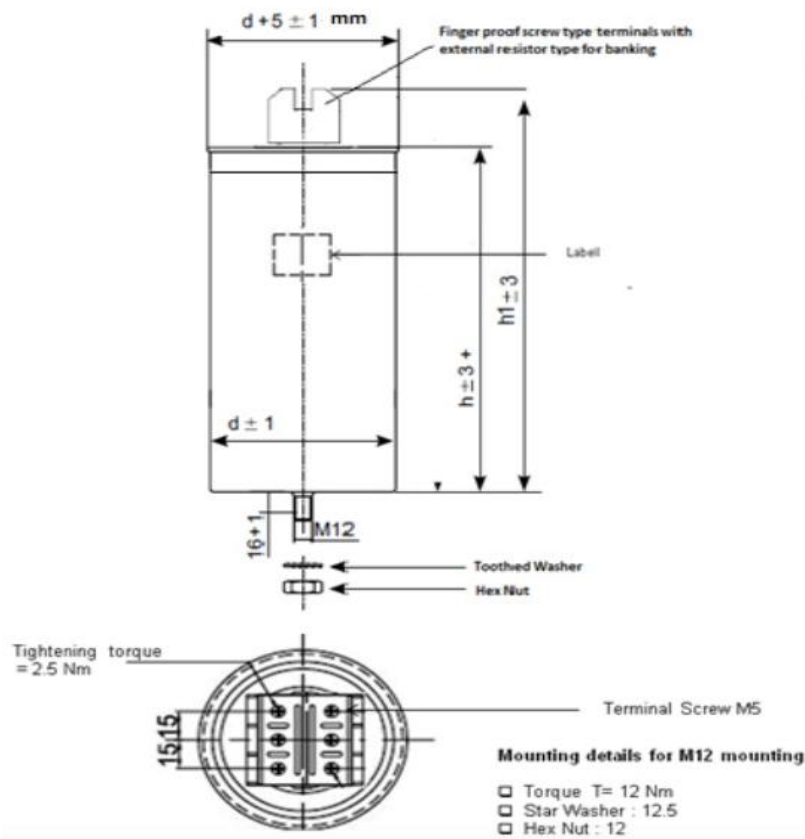


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## Q cap L Cylindrical Capacitor Heavy Duty 440V

KVAR	Capacitance uF	Rated Current (A)	Dimensions (mm)	
			d	h
5.0	27.4	6.6	75	160
6.0	32.9	8.0	75	160
7.5	41.0	9.8	75	272
8.33	45.7	10.9	75	272
10	54.8	13.1	75	272
12.5	68.5	16.4	85	272
15	82.2	19.7	90	272
17.5	96.0	22.9	100	272
20	109.7	26.2	90	354
22.5	123.4	29.5	100	354
25	137.1	32.8	100	354
27.5	150.8	36.0	116	354
30	164.5	39.4	116	354

\*  $h_1 = h + 40\text{mm} \pm 3$



## Q cap L Cylindrical Capacitor Heavy Duty 440V

### Cautions and warnings

- § In case of dents or any other mechanical damage, capacitors must not be used at all.
- § This applies also in case of oil leakages.
- § To ensure the full functionality of the overpressure disconnecter, elastic elements must not be hindered and a minimum space of 12 mm has to be kept above each capacitor basic cell.
- § Do not handle the capacitor before it is discharged.
- § Resonance cases must be avoided by appropriate application design in any case.
- § Handle capacitors carefully, because they may still be charged even after disconnection due to faulty discharging devices.
- § Protect the capacitor properly against over current and short circuit.
- § Failure to follow cautions may result, worst case, in premature failures, bursting and fire.

### Discharging

Capacitors must be discharged to a maximum of 10% of rated voltage before they are switched in again. This prevents an electric impulse discharge in the application, influences the capacitor's service life and protects against electric shock. The capacitor must be discharged to 50 V or less within 1 minute. There must be not any switch, fuse or any other disconnecting device in the circuit between the power capacitor and the discharging device. Discharge and short circuit capacitor before handling!

### Service life expectancy

Electrical components do not have an unlimited service life expectancy; this applies to self-healing capacitors too. The maximum service life expectancy may vary depending on the application the capacitor is used in.

### Safety

Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result from bursting of the capacitor or from expulsion of oil or melted material due to mechanical disruption of the capacitor.

- § Ensure good, effective grounding for capacitor enclosures.
- § Provide means of disconnecting and insulating a faulty component/bank.
- § The terminals of capacitors, connected bus bars and cables as well as other devices may also be energized.
- § Follow good engineering practice.

### Thermal load/over-temperature

After installation of the capacitor it is necessary to verify that maximum hot-spot temperature is not exceeded at extreme service conditions.

## Q cap L Cylindrical Capacitor Heavy Duty 440V

### Overpressure Disconnecter

To ensure full functionality of an overpressure disconnecter, the following must be observed:

1. The elastic elements must not be hindered.
2. Maximum allowed fault current of 10000 A in accordance with UL 810 standard must be assured by the application.
2. Stress parameters of the capacitor must be within the IEC60831/IS13340 specification.

### Overcurrent and short circuit protection

- § Use HRC fuses or MCCBs for short circuit protection. Short circuit protection and connecting cables should be selected so that 1.5 times the rated capacitor current can be permanently handled.
- § HRC fuses do not protect a capacitor against overload - they are only for short circuit protection.
- § The HRC fuse rating should be 1.6 to 1.8 times rated capacitor current.
- § Do not use HRC fuses to switch capacitors (risk of arcing).
- § Use thermal magnetic over current relays for overload protection.

### Resonance cases

Resonance cases must be avoided by appropriate application design in any case. Maximum total RMS capacitor current (incl. fundamental harmonic current) specified in technical data must not be exceeded.

### Re-switching vs. phase-opposition

In case of voltage interruption, a sufficient discharge time has to be ensured to avoid phase-opposition and resulting high inrush currents.

### Vibration resistance

The resistance to vibration of capacitors corresponds to IEC 68, part 2–6.

Max. test conditions:

Test duration	6 h*
Frequency range 1	10 ... 55 Hz*
Displacement amplitude	0.75 mm*

\*corresponding to max. 98.1 m/s" or 10 g

These figures apply to the capacitor alone. Because the fixing and the terminals may influence the vibration properties, it is necessary to check stability when a capacitor is built in and exposed to vibration. Irrespective of this, you are advised not to locate capacitors where vibration amplitude reaches the maximum in strongly vibrating equipment.

### Mechanical protection

The capacitor has to be installed in a way that mechanical damages and dents in the aluminum can are avoided.

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### Grounding

The threaded bottom stud of the capacitor has to be used for grounding. In case grounding is done via metal chassis that the capacitor is mounted to, the layer of varnish beneath the washer and nut should be removed. The maximum tightening torque is 10 Nm for M12 stud and 4Nm for M8 stud.

### Maintenance

- § Check tightness of the connections/terminals periodically.
- § Take current reading twice a year and compare with nominal current. Use a harmonic analyser or true effective RMS-meter.
- § In case of current above the nominal current check your application for modifications.
- § If a significant increase in the amount of non-linear loads has been detected, then a consultant has to be called in for a harmonic study.
- § In case of the presence of harmonics installation of a de-tuned capacitor bank (reactors) must be considered.
- § Check the temperature of capacitors directly after operation for a longer period, but make sure that the capacitors have been switched off. In case of excessive temperature of individual capacitors, it is recommended to replace these capacitors, as this should be an indication for loss factor increase, which is a sign for reaching end of life.

### Storage and operating conditions

Do not use or store capacitors in corrosive atmosphere, especially where chloride gas, sulphide gas, acid, alkali, salt or the like are present. In dusty environments regular maintenance and cleaning especially of the terminals is required to avoid conductive path between phases and/or phases and ground.