

POWER FACTOR CORRECTION  
BY THYRISTER SWITCHING

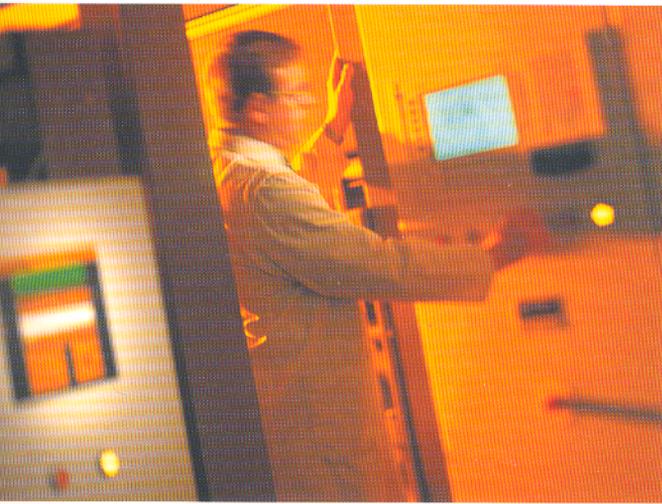


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## FEATURES OF THYRISTER SWITCHING

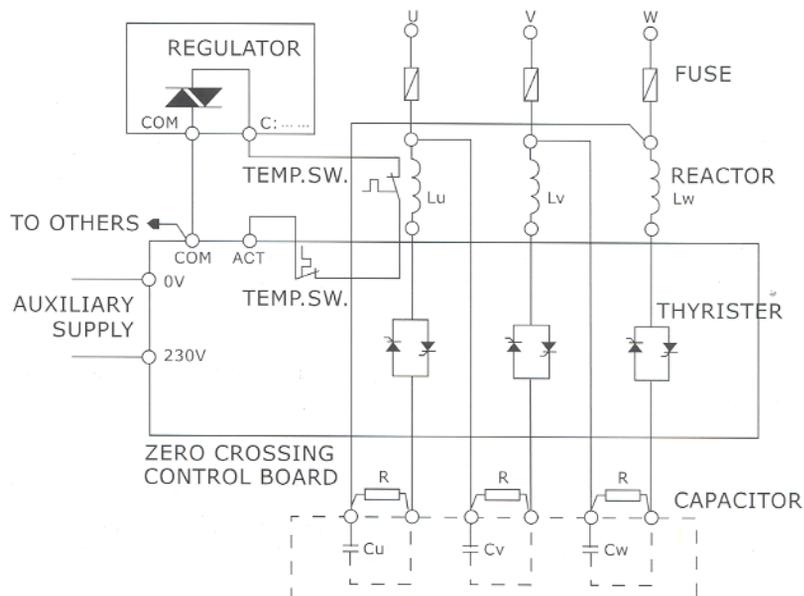


In the current industries where large nos. of fast and frequent load variation such as the lifts, spot welders and variable speed drives, a traditional reactive power compensation system switched on and off by the magnetic contactor (MC) can never satisfy the very fast response time required due to the limit of characteristics of electro-mechanical switching devices, as well as the requirement of the safety discharging time of the capacitors.

The latest innovation in the micro-electronics, a whole new concept of the zero-crossing operation achieved by the electronic thyristor is being introduced to the industries with very satisfaction thanks to the extremely fast response time with additional features as below.

- Fastest response time : switching ON speed within one cycle after receipt of the firing signal, can comply with need from most of the fluctuated industrial loads. A true single phase "real-time" response can also be ordered on request.
- Unlimited nos. of ON and OFF switching operations : the advantage of latest zero-crossing technology allowing a very frequent ON and OFF connections of capacitor.
- No on-inrush current : capacitor is always connected at the zero voltage across the thyristors, this means connection to mains only taking place when the voltages of capacitor and network in the thyristor are equal and in sync. This skips the switching on inrush current and arcing commonly introduced by the MC switching. In addition, all interference such as notches and disturbance resulted by inrush current will be extinguished.
- Zero off-transient : capacitor is only disconnected from network when current waveform passing through the zero point, this also eliminates the off-transient.
- Lifetime expansion : by elimination of the inrush and transient, the weariness of the capacitor insulation commonly resulted by MC can be neglected, in the meantime extends the lifetime of capacitor and saves the cost of routine replacement. The initial investment in the thyristor switching power factor compensation installation can be paid back within limited period.

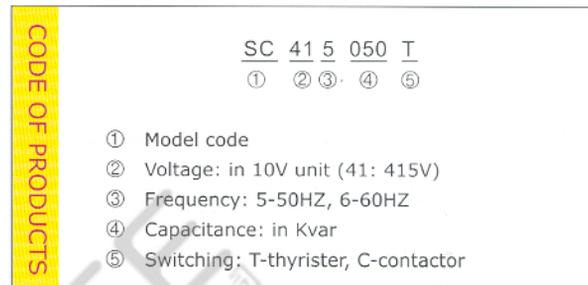
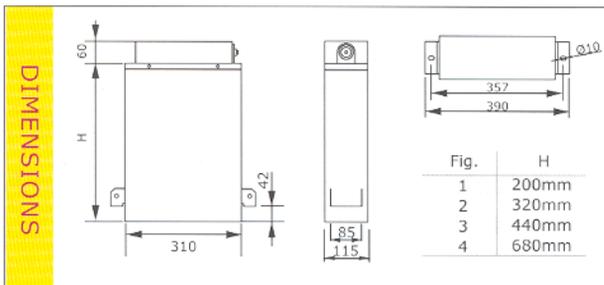
## SCHEME OF THYRISTER SWITCHING



# POWER FACTOR CAPACITORS SC SERIES

SC series 3-phase power factor capacitors are the latest generation of dry type, self-healing, metalized polypropylene dielectrics, very low losses with internal fuse construction. SC series capacitors are designed in four frames of rigid steel case, allowing to be vertically or horizontally mounted without special accessories required.

SC capacitors are of modular concept with group of elements in parallel, each single element is housed in a high temperature rated plastic vessel and insulated by resin filled, and in between the elements, flame-retardant vermiculite is fulfilled to ensure all elements are free from movement. Connection is made through the high conductivity brass terminals atop and housed in a high mechanical strength ABS cover for safety. All capacitors frames are suitably engineered for self-dissipation of heat without forced ventilation required.



## RATING AND DIMENSIONS TABLE

Single phase capacitors are also available on request.

VOLT Fig. HZ Kvar	5 2 5		4 8 0		4 6 0		4 4 0		4 1 5		4 0 0		3 8 0		2 6 0		2 4 0		2 3 0		2 2 0		2 0 8	
	50	60	50	60	50	60	50	60	50	60	50	60	50	60	50	60	50	60	50	60	50	60	50	60
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2
20	2	2	2	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	1	2	2	2	2
25	2	2	2	2	2	1	2	1	2	1	1	1	1	1	2	2	2	2	2	2	2	2	2	2
30	2	2	2	2	2	1	2	2	2	2	1	1	1	1	2	2	2	2	2	2	2	2	3	2
35	2	2	2	2	2	2	2	2	2	2	2	1	2	1	2	2	3	2	3	2	3	2	3	3
40	3	2	3	3	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	2	3	3	3	3
45	3	3	3	3	2	2	2	2	3	2	2	2	2	2	3	3	3	3	3	3	3	3	-	-
50	3	3	3	3	3	2	3	2	3	3	2	2	2	2	4	4	4	4	4	4	4	4	-	-
60	3	3	4	3	3	2	3	3	3	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
70	4	3	4	4	3	3	4	3	4	3	2	2	3	2	-	-	-	-	-	-	-	-	-	-
75	4	4	4	4	3	3	4	3	4	3	3	2	3	3	-	-	-	-	-	-	-	-	-	-
80	4	4	-	4	3	3	4	3	4	4	3	3	3	3	-	-	-	-	-	-	-	-	-	-
90	4	4	-	4	4	4	4	4	4	4	3	3	3	3	-	-	-	-	-	-	-	-	-	-
100	4	4	-	4	4	4	4	4	-	4	3	3	4	3	-	-	-	-	-	-	-	-	-	-

## CHARACTERISTICS

- Conform to standards : BSE 1650, IEC 60831, IEC 70 and VDE 560.
- Working temperature : - 25°C ~ + 50°C, 95% R.H. non-condensation.
- Range of voltages : 190, 200, 208, 220, 230, 240, 260, 380, 400, 415, 440, 460, 480 & 525V, 50/60Hz.
- Range of ratings:
  - 1). 190 - 208V : 2.5 - 40Kvar
  - 2). 220 - 260V : 5 - 50Kvar
  - 3). 380 - 460V : 5 - 100Kvar
  - 4). 480 - 525V : 5 - 100Kvar
- Capacitance tolerance : within -5% ~ +10% of nominal per IEC 60831 regulation.
- Dielectric losses : 0.5 watt / Kvar
- Isolation resistance : > 1,000,000 M.Ω .μ F
- Dielectric strength:
  - 1). Between terminals : 2.15 x Un, 10s
  - 2). Between terminals and earth : 3KV, 1 minute
- Maximum over voltage : 1.1 x Un for permanent
- Maximum over current : 1.3 x In for permanent and 5 x In for inrush.
- Protection degree : IP42 (cover type) or IP30 (cap type).
- Discharge resistors : below 50V within one minute after disconnection per IEC 60831.

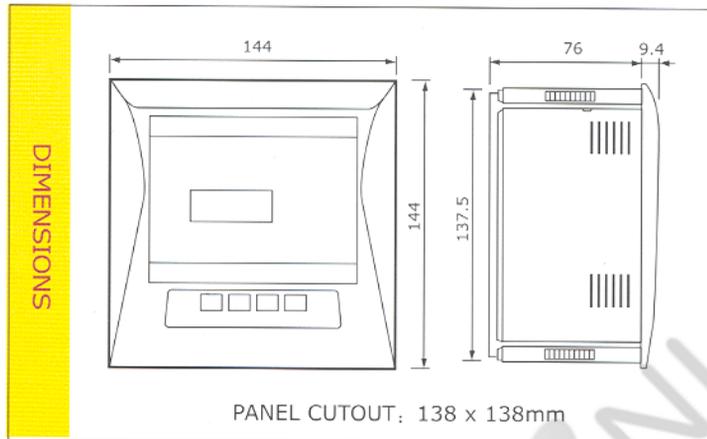
# POWER FACTOR REGULATOR PFR SERIES

PFR series power factor regulators are sized to DIN standard 144mm x 144mm layout, specially engineered for an intelligent response operation in accordance with switching application. The regulator is constructed by the latest microprocessor technologies incorporated the high speed detection and internal phase adjustment which makes the user's field programming very handy. It monitors the load variation and gives smart commands for the capacitor connection or disconnection of groups to true demand. This leads an very fast response time and

provides superior reactive power compensation to the network.

Model PFR-8C (8 steps) and PFR-14C (14 steps) are designed for the magnetic contactor (MC) switching with 10A/380Vac rated relay output. For thyristor switching application, models PFR-8T (8 steps) and PFR-14T (14 steps) are developed with real time compensation by using the opto-coupler output technology instead.

Single phase application also available on request.



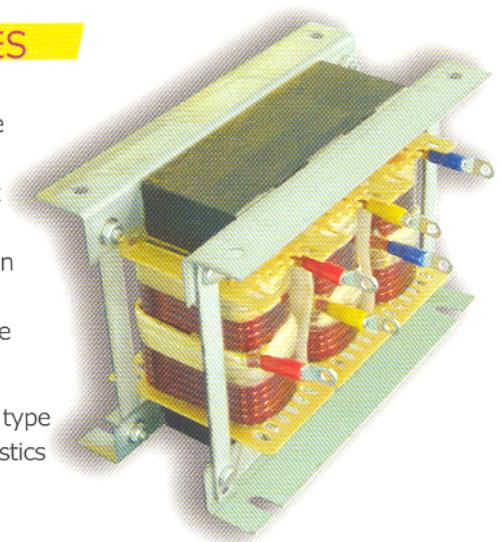
## CHARACTERISTICS

- Conform to standards : EN61010-1, IEC1010-1, EN50081-2, EN500082-2.
- Operational ambient :  $-10^{\circ}\text{C} \sim +50^{\circ}\text{C}$ , 90% R.H. non-condensation.
- Auxiliary supply : 230V/400V +/- 15%, 45 ~ 65Hz.
- Burden:
  - 1). Voltage circuit : 5VA
  - 2). Current circuit : 0.5VA
- Protection degree :
  - 1). IP64 from the front.
  - 2). IP31 from the rear terminals.
- Field programmable with 4 navigation buttons in the front panel.
- Power factor setting range : 0.80 lagging ~ 0.95 leading.
- Automatic C/K (co-efficient) calculation thanks to the intelligent CPU incorporated.
- Manual operation is also available through the buttons provided in front panel, however an automatic mode is always advisable.
- Response time ( $T_r$ ) : adjustable from 0.10 ~ 9.99 seconds (T model) or 4 ~ 999 seconds (C model).
- Safety reconnection time ( $T_s$ ) : adjustable from 0.10 ~ 9.99 seconds (T model) or 20 ~ 999 seconds (C model).
- High harmonic alarm (d%) setting range : from 0 ~ 999% adjustable (set "000" as function disable).
- LED displays of power factor, load current and harmonic content (d%) measurement.
- Alarms for insufficient compensation (CE), high distortion (dE), high auxiliary voltage (UE) and current setting error (AE) with one "C" contact output relay.
- Five selective programs : 1:1:1:1, 1:1:2:2, 1:2:2:2, 1:2:4:4 and 1:2:4:8.
- Phase rotation internal adjustment for V / A input combination error.
- Current input 5A with overload capability:
  - 1). 10A for permanent
  - 2). 50A for 10 seconds
- RS-485 serial communication optional for 14 steps type.

# DETUNED REACTORS QRT AND QRC SERIES

Series QRT and QRC reactors are designed for the high frequency disturbance filtering and specific harmonics blocking, it reduces the harmonic current, improves the loss of power factor capacitor banks and with protection against the damage resulted by the resonance from the network. These reactors are of dry type construction with class F insulation, made by high permeability iron sheet cores with high conductivities copper coils or aluminum foils winding. Reactors are vacuum impregnated with varnish coating for improvement of the dielectric properties.

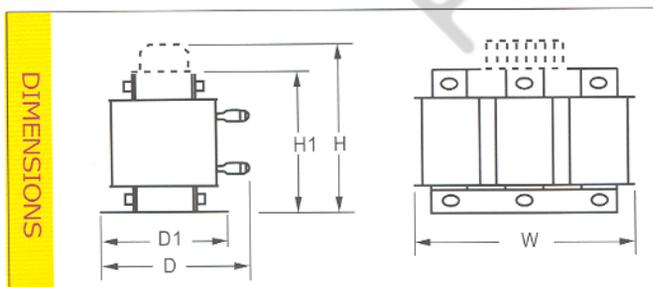
Model QRC is for conventional magnetic contactor switching application while type QRT is dedicated for the thyristor switching connection with special characteristics in compliance with the fast response operation requirement



## RATINGS

Special ratings also available on request.

Code	Rated Power (Kvar)	Inductance (mH)	Rated Current (A)	Dimensions(mm)					Approx. Weight (kg)
				H	H1	W	D	D1	
QRC4150107	10	3.62	14.89	215	150	180	95	95	7.96
QRC4150157	15	2.42	22.33	240	180	210	115	115	11.44
QRC4150207	20	1.81	29.77	270	205	240	113	113	15.40
QRC4150257	25	1.65	37.22	275	205	240	140	140	16.00
QRC4150307	30	1.37	44.66	275	205	240	160	150	25.50
QRC4150407	40	1.03	59.55	215	205	240	220	160	28.40
QRC4150507	50	0.82	74.43	240	230	270	220	166	29.22
QRC4150607	60	0.687	89.32	240	230	270	230	172	30.62
QRC4150807	80	0.516	119.1	-	265	310	250	192	43.92
QRC4151007	100	0.414	148.9	-	265	310	270	195	46.06



**CODE OF PRODUCTS**

QRC 41 5 050 7  
① ② ③ ④ ⑤

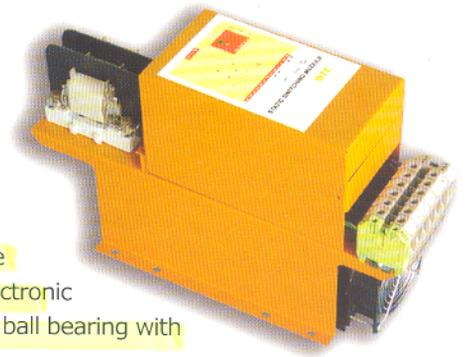
- ① Model code: QRT and QRC
- ② Voltage: in 10V unit (41: 415V)
- ③ Frequency: 5-50HZ, 6-60HZ
- ④ Capacitor Rating: in KVAR
- ⑤ Detuned Factor (P%): 6, 7, 14

## CHARACTERISTICS

- Conform to standards IEC 298 and IEC 076.
- Working temperature : - 20°C ~ + 45°C, 95% R.H. non-condensation.
- Range of standard products :
  - 1). 190 - 220V : 5 - 50Kvar in 5Kvar increment.
  - 2). 230 - 260V : 5 - 60Kvar in 5Kvar increment.
  - 3). 380 - 460V : 5 - 100Kvar in 5Kvar increment.
  - 4). 480 - 525V : 5 - 100Kvar in 5Kvar increment.
- Insulation : Class F (155°C). Higher level available on request.
- Isolation testing voltage : standard 3000V, higher level on request.
- Tolerance of reactance : +/- 3%.
- Linearity of inductance : standard 1.75 x In.
- Transient overload capability : 2 x In.
- Detuned factor (p = %) : standard range in 7%, 6% and 14%. Others on request.
- Typical models and dimensions of 415V, 50Hz, p=7% of QRC as shown above, please consult factory for layouts of others.

## STATIC SWITCHING MODULE SSM AND SCM SERIES

SSM (6-lead) and SCM (3-lead) series static switching modules are of compact package, offering a handy method of switchboard installation based on the modular and field expandable concept that fits up with any type of the cubicles construction in the industries. All control electronics have been engineered to T70 grade specifically to the enclosed ventilated operation.

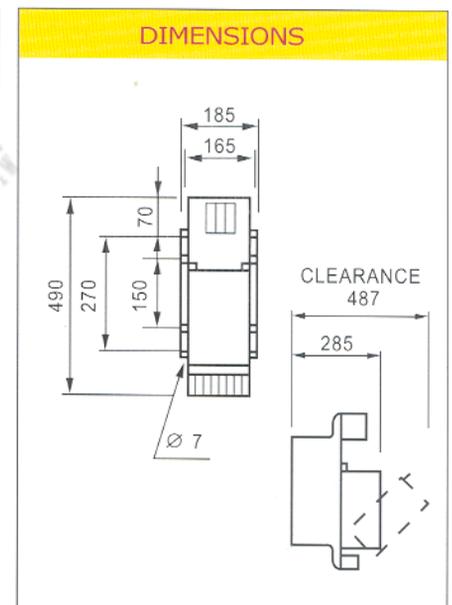


This module consists of the DIN standards NH-00 type fuses in the top for overload and short circuit protection, output terminals blocks for customer's connection in the bottom. Thyristers, internal control wiring and the zero-crossing switching micro-electronic devices are housed in one completed construction. In addition, an industrial grade, ball bearing with low noise fan controlled by thermostat is incorporated for temperature control.

SSM and SCM are available for the standard 230V and 400V line voltages with frames of three as shown below. Special mains voltage and current rating are also available on request.

### RATING TABLE

CODE	MAINS	MAX KVAR	CABLE	FUSE RATING
SSM40-40	380~415V	40Kvar/400V	10mm <sup>2</sup>	80A
SSM40-60	380~415V	60Kvar/400V	16mm <sup>2</sup>	125A
SSM40-80	380~415V	80Kvar/400V	25mm <sup>2</sup>	160A
SSM23-25	220~240V	25Kvar/230V	10mm <sup>2</sup>	80A
SSM23-37	220~240V	37.5Kvar/230V	16mm <sup>2</sup>	125A
SSM23-45	220~240V	45Kvar/230V	25mm <sup>2</sup>	160A
SCM40-20	380~415V	20Kvar/400V	16mm <sup>2</sup>	40A
SCM40-30	380~415V	30Kvar/400V	25mm <sup>2</sup>	63A
SCM40-50	380~415V	50Kvar/400V	35mm <sup>2</sup>	100A
SCM23-15	220~240V	15Kvar/230V	16mm <sup>2</sup>	63A
SCM23-20	220~240V	20Kvar/230V	25mm <sup>2</sup>	80A
SCM23-25	220~240V	25Kvar/230V	35mm <sup>2</sup>	100A



### CHARACTERISTICS

- Conform to standards : IEC 60439 & IEC 146
- Working ambient temperature : -10°C ~ + 50°C, 90% R.H. non-condensation.
- Fuses : DIN standard HRC type, up to 160A.
- Protection degree : IP00 standard, IP20 or higher grade protective fuse caps on request.
- Control supply voltage : 200 ~ 240Vac, 50 / 60Hz.
- Output relay : one NO ('a') contact rated 5A/250Vac for switching status.
- Input firing signal : dry contact or opto-coupler
- Overload capability : 1.5 times rated current for 60 seconds
- Thermostat protection :
  - 1) 80°C (switching disconnection).
  - 2) 40°C (fan ON)

# CAPACITOR BANK SBR AND SBC SERIES

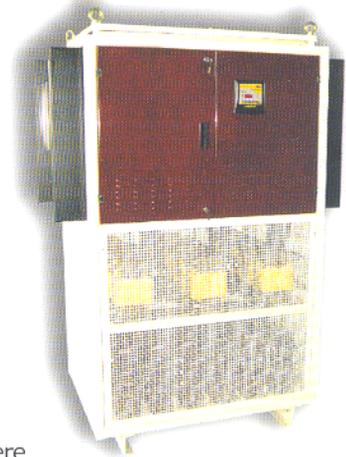
QTC series SBC and SBR thyristor switching reactive power compensation bank is an expandable design, freestanding cubicle made by sheet steel with powdered coating. The bank consists of the NH-00 fuse protection of each step, fast response regulator, capacitors, reactors and zero-crossing switching control devices, all housed in a very compact IP20 enclosure. Heat dissipation is achieved by natural cooling of heatsink with no forced ventilation required which ensure the reliability of the installation also maintenance-free.

Customer's connection is accessed through the knockouts provided at both sides underneath heatsinks, also additional cutout atop of cubicle to make the large current delivery by modern electrical bus duct accessible. This improves the filed flexibility and alignment in a limited space electrical room where commonly more than one reactive power compensation system installed.

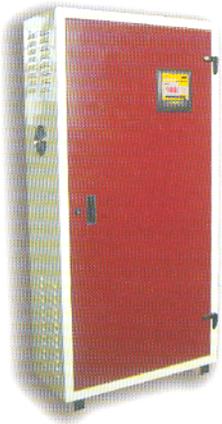
SBR series : Capacitor bank with standard 7% (or 6% on request) detuned reactors in series with capacitors for 5th and 7th harmonics blocking, suitable to the industrial loads with harmonic contents. Standard ranges from 70Kvar to 960Kvar (380 ~ 415V line voltage) or 35Kvar to 480Kvar (220 ~ 240V line voltage), both 50 and 60Hz.

SBC series : Capacitor bank without reactors suitable for general application with low harmonics concern. Standard ranges from 70Kvar to 960Kvar (380 ~ 415V line voltage) or 35Kvar to 480Kvar (220 ~ 240V line voltage), both 50 and 60Hz.

Other compact series (SBF and SBW), special mains voltage, detuned factor and configurations are also available on request.



SBR and SBC

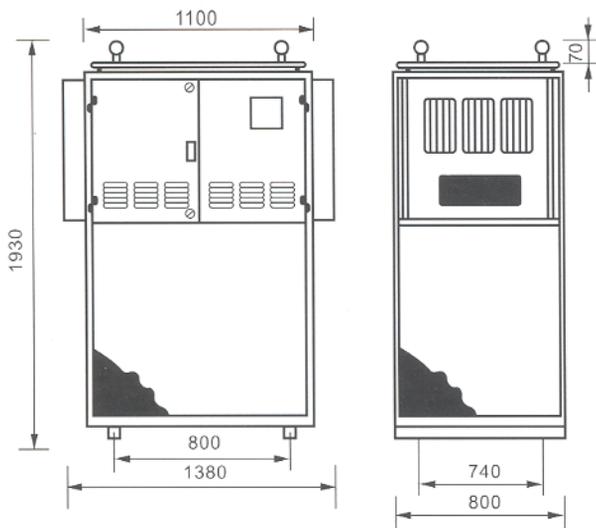


SBF



SBW

DIMENSIONS (SBR/SBC)



A : 1380mm (w) x 800mm (d) x 1930mm (h)  
 B : 2760mm (w) x 800mm (d) x 1930mm (h)

CODE OF PRODUCTS  
SBR/SBC

SBR 41 5 070 A -14  
 ① ②③ ④ ⑤ ⑥

- ① Model code: SBC, SBR
- ② Voltage: in 10V unit (41: 415V)
- ③ Frequency: 5-50HZ, 6-60HZ
- ④ Total Capacity: in Kvar
- ⑤ Cubicle: A or B
- ⑥ Special detuned P: in %

CODE OF PRODUCTS  
SBF/SBW

SBF 41 5 120 (20X6)  
 ① ②③ ④ ⑤

- ① Model code: SBF, SBW
- ② Voltage: in 10V unit (41: 415V)
- ③ Frequency: 5-50HZ, 6-60HZ
- ④ Total Capacity: in Kvar
- ⑤ Configuration: Kvar x Step

## TYPICAL RATING TABLE

### 415V SBR and SBC series

Code	Kvar	Configuration	Steps
415070A	70	10+20+40	3
415110A	110	10+20+40X2	4
415150A	150	10+20+40X3	5
415190A	190	10+20+40X4	6
415105A	105	15+30+60	3
415165A	165	15+30+60X2	4
415225A	225	15+30+60X3	5
415285A	285	15+30+60X4	6
415140A	140	20+40+80	3
415220A	220	20+40+80X2	4
415300A	300	20+40+80X3	5
415380A	380	20+40+80X4	6
415210A	210	30+60X3	4
415270A	270	30+60X4	5
415330A	330	30+60X5	6
415200A	200	40+80X2	3
415280A	280	40+80X3	4
415360A	360	40+80X4	5
415440A	440	40+80X5	6
415480A	480	80X6	6
415540B	540	20+40+80X6	8
415620B	620	20+40+80X7	9
415700B	700	20+40+80X8	10
415780B	780	20+40+80X9	11
415860B	860	20+40+80X10	12
415600B	600	40+80X7	8
415680B	680	40+80X8	9
415760B	760	40+80X9	10
415840B	840	40+80X10	11
415920B	920	40+80X11	12
415960B	960	80X12	12

### 240V SBR and SBC series

Code	Kvar	Configuration	Steps
245035A	35	5+10+20	3
245055A	55	5+10+20X2	4
245075A	75	5+10+20X3	5
245095A	95	5+10+20X4	6
245070A	70	10+20X3	3
245110A	110	10+20+40X2	4
245150A	150	10+20+40X3	5
245190A	190	10+20+40X4	6
245105A	105	15+30X3	4
245135A	135	15+30X4	5
245165A	165	15+30X5	6
245100A	100	20+40X2	3
245140A	140	20+40X3	4
245180A	180	20+40X4	5
245220A	220	20+40X5	6
245240A	240	40X6	6
245270B	270	10+20+40X6	8
245310B	310	10+20+40X7	9
245350B	350	10+20+40X8	10
245390B	390	10+20+40X9	11
245430B	430	10+20+40X10	12
245300B	300	20+40X7	8
245340B	340	20+40X8	9
245380B	380	20+40X9	10
245420B	420	20+40X10	11
245460B	460	20+40X11	12
245480B	480	40X12	12

Others configuration on request

## CHARACTERISTICS

- ▣ Conform to standards : IEC 60831, 60289, 60439 and 60555-5
- ▣ Working temperature : - 25°C ~ + 45°C, 95% R.H. non-condensation.
- ▣ Mains voltage : from 200 ~ 500V, 50Hz or 60Hz.
- ▣ Installation : indoor only, for outdoor application please consult factory.
- ▣ Protection degree : IP20 standard, reinforcement type on request.
- ▣ Steps : standard 6 and 12, extra steps also available on request.
- ▣ Main disconnector switch (DS) : from 250A to 1600A optional.

# QTC PTY.LTD.

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Due to the continuous improvement of products,  
specifications are subject to change without notice.

## SALES OFFICE

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