Shunt Power Capacitor

Film-foil type, oil impregnated

Series/Type:	**Dura Cube Heavy Duty Capacitors**
Ordering code:	**B25160D5***T*25**
Date:	December 2022
Version:	1

Applications
Shunt Power Factor Correction

Technology
APP (Film foil capacitor)

Material
Dielectric: Double layer Biaxially Oriented Hazy Polypropylene (BOPP) film
Electrode: Aluminum foil
Impregnant: Non PCB, biodegradable oil
Casing: Metallic, CRCA (Cold Rolled Cold Annealed)
Case Insulation: Pressphan paper
Bushings: Polymeric
Terminals: Brass stud with two plain washers and hex head nuts (Refer drawing).
Discharge device (external): Carbon film or metal oxide film or thick film resistor.
Paint: Epoxy, Light gray (Shade 631 as per IS 5:2005)

Construction
Element: Flat, elliptical, extended foil type
Element connection: Soldered type
Internal fuse: Provided
Discharge device: Provided (external)
Sealing: Hermetically sealed

Technical data

Specifications	
Rated output Q_N	Refer table No. 1
Rated capacitance C_R	
Rated current I_R	
Rated voltage U_N	525 V AC
Rated frequency f_R	50 Hz
Capacitance tolerance	-5 / +10%
No. of phases and connections	Three phase, internally Δ connected
tan δ (Dielectric)	≤ $2 \cdot 10^{-4}$

Table No. 1

Ordering Code	Rated output Q_N	Rated capacitance C_R	Rated current I_R
B25160D5010T025	10.0	57.7	11.0
B25160D5015T025	15.0	86.6	16.5
B25160D5020T025	20.0	115.5	22.0
B25160D5025T025	25.0	144.4	27.5
B25160D5030T025	30.0	173.2	33.0
B25160D5033T025	33.0	191.1	36.4
B25160D5040T025	40.0	231.0	44.0
B25160D5050T025	50.0	288.7	55.0
B25160D5060T025	60.0	346.6	66.0

Maximum permissible electrical operating conditions	
Long duration voltages	1.00 • V_R – Continuous 1.10 • V_R – 8 hours in every 24 hours 1.15 • V_R – 30 minutes in every 24 hours 1.20 • V_R – 5 minutes 1.30 • V_R – 1 minute
Long duration currents	2 • I_R (including combined effects of harmonics, over voltages and capacitance tolerance)
Switching operations	15000 per year
Switching current	400 • I_N
Life expectancy	250000 Hrs. (at rated voltage, rated frequency & -10/D temperature category)

Test data		
1	Sealing test	To check integrity of sealing
2	V_{TT}	4.3 • V_R DC for 10 s
3	Discharge device test	To check capacitor discharge time after isolation of electric supply.
4	V_{TC}	3 kV rms for 10 s / 3.6 kV rms for 2 s of power frequency
5	C measurement	At 0.9 to 1.1 • V_R between terminals
6	tan δ measurement	At 0.9 to 1.1 • V_R between terminals
7	Visual	For dimensions, finish, marking

Note: Tests 2 to 7 carried out at room temperature.

All ac tests carried out at 50 Hz, 1-Φ

Limiting environmental conditions	
Application duty	Indoor
Altitude	2000 m (max.) above mean sea level
Ambient temperature T_{min}	Category: -10/D -10 ºC
T_{max}	+55 ºC (max. 1 hour / day) +45 ºC (highest mean over any period of 24 hours) +35 ºC (highest mean over any period of one year)
Casing temperature	60 ºC max.
Humidity	20% to 95% RH
Degree of pollution	No corrosive salt, dust & sand laden. No chemical fumes, chloride gas, sulphide gas, acidic or alkaline fumes, etc. in surrounding air. No deposition of conducting particles.
Mould growth	Not conducive for mould growth. Should be protected from fungus and vermin.
Seismic zone factor	0.24 (max.) corresponding to seismic zone IV - severe 0.15g (both horizontal & vertical direction)
Vibrations	Not expected. To be installed on rigid, steady, level surface.

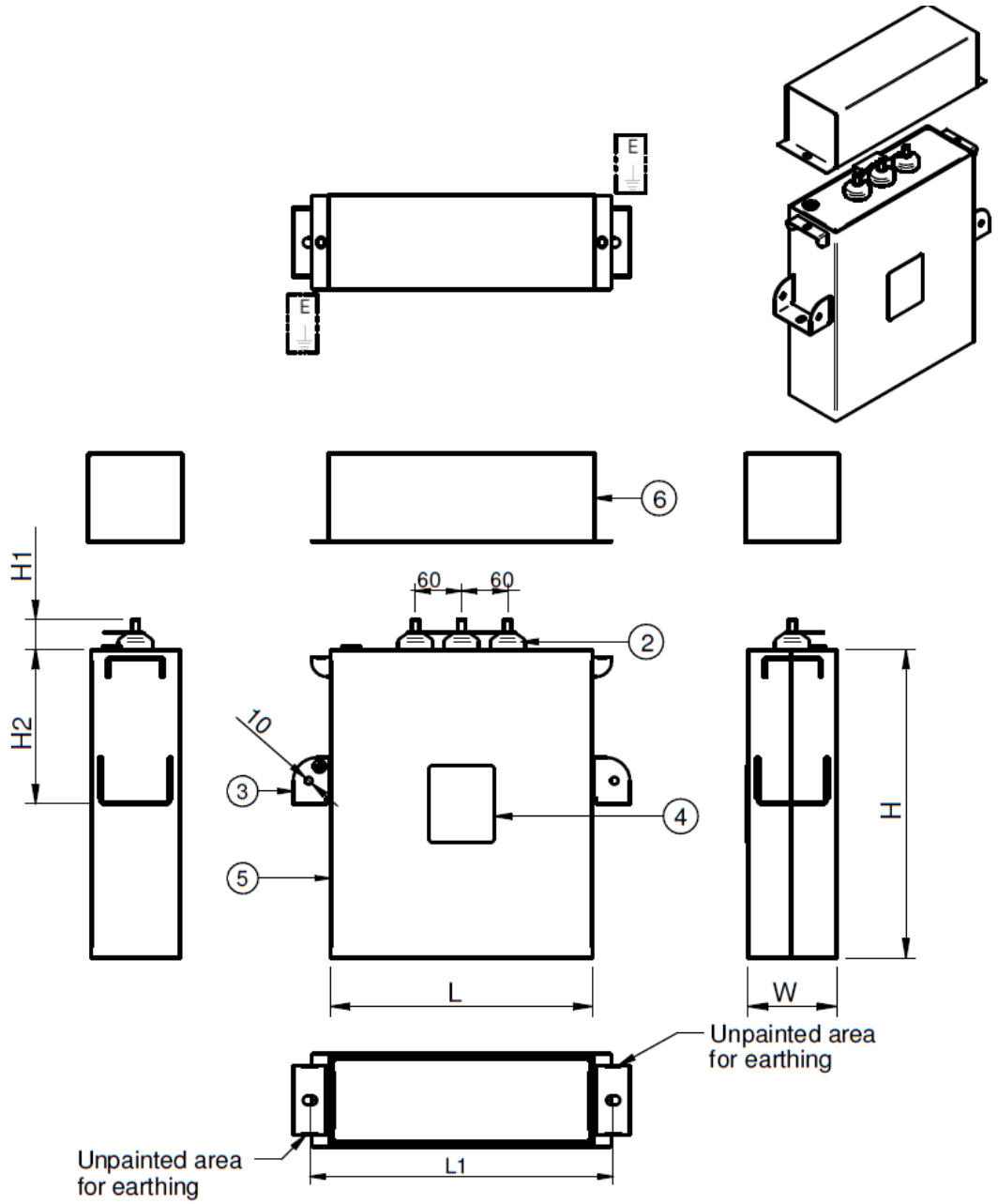
Charateristics	
Application	Indoor
Insulation class (IEC60085)	90
Degree of protection	IP00
Cooling	ONAN
Creepage distance	25 mm / kV
Discharge time	3 minutes
Residual voltage	Less than 75 V
Temperature rise at rated voltage, frequency & room temperature	10 ^{0}C (max.) container

Reference standards
IS 13585 (Part 1): 2012 / IEC 60931-1 : 1996

Approval mark	Reference standards	Certificate
	IS 13585 (Part 1): 2012 / IEC 60931-1 : 1996	ISI Mark applicable to 440 V, 480 V and 525 V ratings

Dimensions and mounting	
Container dimensions	As per drawing
Net weight	As per drawing
Earthing	Separate unpainted brackets provided on two sides.
Mounting / Lifting	Metal brackets provided on sides.
Mounting position	Vertical/Horizontal Should not be mounted upside down (bushing at bottom) or in cantilever position.
Terminal tightening torque	M10 terminal – 6.0 to 7.0 Nm

Drawings



ITEM NO	DESCRIPTION	MATERIAL	QTY
1	TERMINAL M10	BRASS (TIN PLATED)	3
2	BUSHING	EPOXY (RED)	3
3	MOUNTING BRACKET	STAINLESS STEEL-409	2
4	RATING STICKER	POLYSTER	1
5	CONTAINER	CRCA	1
6	TERMINAL COVER	CRCA	1

Note:-
1. Indoor installation
2. IP class 00

Sr. No.	V_R V	Q_N kVAr	L1 mm	L mm	W mm	H mm	H1 mm	Terminal	Cable entry hole Ø mm	Mounting slot mm	Approximate weight kg
1	525	10	394	340	115	150	150	M10	30	10 x 15	15
2	525	15	394	340	115	200	200	M10	30	10 x 15	18
3	525	20	394	340	115	275	275	M10	30	10 x 15	18
4	525	25	394	340	115	300	100	M10	30	10 x 15	23
5	525	30	394	340	115	350	100	M10	30	10 x 15	30
6	525	33	394	340	115	375	100	M10	30	10 x 15	30
7	525	40	394	340	115	450	200	M10	30	10 x 15	35
8	525	50	394	340	135	450	200	M10	30	10 x 15	40
9	525	60	394	340	135	525	200	M10	30	10 x 15	48

Note: The dimensions in datasheet are tentative. Please get in touch with respective sales at the time of ordering.

Protections required for capacitor

Following protection should be provided to each capacitor bank:

1) Short circuit / earth fault protection using external fuses OR MCB/MCCB.
2) Over voltage protection. (Setting ≤ 110% of nominal system voltage).
3) Under voltage / no voltage sensing with time delay interlock to avoid sudden re-switching of capacitor.

   In case of voltage interruption, time delay interlocking of minimum 3 minutes to be provided between disconnection (power OFF) and re-connection (power ON) of capacitor. Voltage sensing in case of switching with solid state switch, ensure residual voltage at capacitor terminal at the instant of switching shall be equal to system voltage. This is required to avoid phase-opposition and resulting high inrush currents.

Following protections should be provided under specific conditions:

1) Over current protection for capacitor banks expected to face harmonics, over current.
   (Fuses generally do not provide suitable over current protection)
2) Surge arrester for capacitors to be subjected to high over voltage transients, lightning surges.
3) Current limiting series reactor/Capacitor duty contactor/Zero crossing switching with the help of solid state switch for capacitors to be subjected to heavy transient currents (e.g. parallel switching, system with high fault level, fluctuating loads on same or nearby network, etc.)
4) Detuned / tuned series reactor for capacitors which are subjected to harmonics.
   (Reactor linearity shall be greater than capacitor current at site condition)

   Check voltage & current harmonics and network characteristics before & after installing capacitor & major changes in load / system parameters. Resonating conditions should always be avoided.

Specific Application considerations

1) Capacitors directly connected across induction motor terminals:

(a) Motor self-excitation: Capacitor connected across induction motor such that after 'switching off' supply, capacitor remains connected across motor terminals while motor rotation has not stopped.
Under such situation, motor will act as a generator with capacitor supplying required excitation.
Capacitor current should be less than 90% of no-load magnetizing current of motor.
Even after switching OFF supply, do not touch live terminals till motor stops rotating.

(b) Connecting capacitor across motor will reduce combined current.
Reduce over Current relay setting when capacitor is connected across motor terminals after CT.

(c) Star-delta / soft starter: Connect capacitor on line side of starter.
Switch 'ON' capacitor after motor stabilizes in normal running mode.

2) Capacitor to compensate power factor of generator, isolated from grid:
Check generator characteristics and voltage regulation control with capacitive load.

(a) During sudden reduction of load, generator should not get over-excited, increasing voltage.

(b) Active power rating of generator should not be exceeded by compensating reactive power.
Due to capacitive compensation, current may not exceed, thus defeating Over Current protection.

3) Capacitors used for harmonic filter application
Complete system details, harmonic details & filter details should be communicated during enquiry to offer capacitor suitable for filtering application.

4) Light load conditions can cause voltage rise, saturation of transformer core, abnormal harmonics, amplification by resonance between transformer & capacitor.
It is recommended to disconnect capacitor bank during light load conditions.

5) Switching device for capacitor bank should be restrike free. Restriking causes switching transients amplification, leading to premature failure of capacitor, switching device & other components.

6) Any bad contact or joints in capacitor circuit giving rise to arcing can cause high frequency oscillations & stressing capacitor.
Bad contact at capacitor terminals may cause heating of stud; affecting sealing integrity, oil leakage / moisture ingress in capacitor unit causing premature failure.

Cautions and warnings

- In case of dents of more than 2 mm depth on metallic container or chiping/breakage of bushing or any other mechanical damage, capacitors must not be used at all.
- In case of oil leakages, capacitor must not be used.
- A minimum required electrical clearance has to be kept around live terminals.
- Adequate ventilation should be provided around capacitor to reduce capacitor temperature rise.
- Handle capacitors carefully, because they will still be charged even after disconnection.
- Do not handle the capacitor before it is discharged.
- Resonance cases must be avoided by appropriate application design in any case.
- Protect the capacitor properly against over current and short circuit.
- Failure to follow cautions may result, worst case, in premature failures, bursting and fire.

Safety

Electrical or mechanical misapplication of capacitors may be hazardous. Personal injury or property damage may result from bursting of the capacitor, impact of broken porcelain pieces having sharp edges or from expulsion of oil or melted or burning 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. Discharge capacitors before touching any part electrically connected to capacitor terminals.
- Installation, commissioning & product application to follow good engineering practice.

Storage and operating conditions

Do not use or store capacitors in corrosive atmosphere, especially where chloride gas, sulphide gas, ammonia, acid, alkali, salt, fumes or the like are present.

Note

For detailed information about PFC capacitors and cautions, refer to the latest version of TDK PFC Product Profile.

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