

**WATER SUPPLIES DEPARTMENT**  
**STANDARD SPECIFICATION E-60-01**  
**LOW VOLTAGE POWER FACTOR CORRECTION CAPACITOR**

1. GENERAL

1.1 Scope

This Specification covers the design, construction, manufacture, testing and delivery of low voltage power factor correction capacitor equipment. The equipment shall include all sub-units and component items to form a complete working system.

1.2 Operation Conditions

Capacitors shall be capable of operating satisfactorily without mechanical or electrical damage or degradation of operating characteristics under the following conditions:

1.2.1 Climate Conditions

- (a) Ambient temperature : 40°C maximum continuous for 4 hours  
35°C average over any 24 hours  
5°C minimum.
- (b) Humidity : Up to 98% relative humidity.
- (c) Altitude : Not greater than 1000 metres.

1.2.2 Electrical Conditions

- (a) Electricity Supply : 380V 3-phase, 50 Hz, 4-wire system with solidly earthed neutral and maximum prospective symmetrical fault current 40 kA.
- (b) Normal limits of voltage variation : -10% to +6%
- (c) Normal limits of frequency variation :  $\pm 2\%$

## 2. DESIGN AND CONSTRUCTION

### 2.1 Design

The capacitor shall comply with IEC 60831 and shall be made of dry type dielectric of metallised polypropylene film. Synthetic impregnant materials which may pollute the environment such as polychlorobiphenyl etc. or may be hazardous in any other way (for example, the material is flammable or gives off toxic gas when burning) will not be accepted unless otherwise approved.

The capacitor shall be designed in a way that it will not cause fire or explosion in the event of failure. It shall be of “self-healing” type with low dielectric loss and the total loss shall be less than 0.5 watt per kvar. Each capacitor shall comprise three phase cells, be delta connected and each fitted with a suitable internal over-pressure disconnecter or fusing device. In addition, a permanently connected discharge device shall be provided for each phase to reduce the residual voltage from the crest value of the rated voltage to less than 50V within one minute after the capacitor is disconnected from the power supply.

### 2.2 Construction

The capacitor enclosure shall be made of sheet steel to IP42 of IEC 60529.

Suitable lifting lugs shall be provided on the capacitor enclosure to facilitate handling during transportation. A printed adhesive rating label shall be provided and fixed on the enclosure. An earth stud terminal shall be provided for the earthing connection of the enclosure.

## 3. INSPECTION AND TESTING

### 3.1 Type Tests

Type test reports/certificates on the following tests to IEC 60831 shall be submitted for assessment upon request. The type tests shall be carried out on a capacitor unit of the same design voltage and construction as the capacitors provided under the contract:-

- (i) Thermal stability test of similar capacitance
- (ii) Measurement of the tangent of the loss angle ( $\tan \delta$ ) of the capacitor at elevated temperature
- (iii) Voltage test between terminals
- (iv) Voltage test between terminals and container
- (v) Lightning impulse voltage test between terminals and container
- (vi) Discharge test
- (vii) Ageing test
- (viii) Self-healing test
- (ix) Destruction test

Type tests shall be certified by a competent witness/testing authority.

### 3.2 Routine Tests

The following routine tests to IEC 60831 shall be carried out at the manufacturer's works on every capacitor before delivery:-

- (i) Capacitance measurement and output calculation
- (ii) Measurement of the tangent of the loss angle ( $\tan \delta$ ) of the capacitor
- (iii) Voltage test between terminals
- (iv) Voltage test between terminals and container
- (v) Test of the internal discharge device
- (vi) Sealing test

Certified test reports shall be submitted to WSD for approval immediately after completion of the tests.

- End of this Specification -