TENDER SPECIFICATION

NO. CLW/ES/3/0664

ALT								

ANNEXURE:

DRG. NOS: 1) CLW/ES/3/SK-1/0664
2) CLW/ES/3/SK-2/0664

TOTAL NO. OF SHEETS:

ALT								
SHEETS								

SPECIFICATION FOR CAPACITOR BANK HARMONIC FILTER FOR WAG-9H, WAP-7 AND WAP-5 LOCOMOTIVES.

ISSUED BY:
DY. CHIEF ELECTRICAL ENGINEER/DESIGN
CHITTARANJAN LOCMOTIVE WORKS
WEST BENGAL, PIN: 713331.

DRN. | CHKD. | AEE/SEE

SPECIFICATION FOR CAPACITOR BANK HARMONIC FILTER FOR WAG-9H, WAP-7 AND WAP-5 LOCOMOTIVES	DY. CEE/D-II	CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL, INDIA. NO. CLW/ES/3/SK-1/0664 DATE:

ALT. NO.	AUTHY.	DESCRIPTION	INITIAL	DATE

DRN. CHKD. AEE/$EE

SPECIFICATION FOR CAPACITOR BANK HARMONIC FILTER FOR WAG-9H, WAP-7 AND WAP-5 LOCOMOTIVES	DY. CEE/D-II	CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL, INDIA. NO. CLW/ES/3/SK-1/0664 DATE:

SPECIFICATION FOR CAPACITOR BANK HARMONIC FILTER FOR THREE PHASE LOCOMOTIVES.

INDEX

DRN. CHKD. AEE/SEE

SPECIFICATION FOR CAPACITOR BANK HARMONIC FILTER FOR WAG-9H, WAP-7 AND WAP-5 LOCOMOTIVES	DY. CEE/D-II	CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL, INDIA. NO. CLW/ES/3/SK-1/0664 DATE:

1.0 SCOPE

This specification covers the manufacture, supply, installation, testing and commissioning of Capacitor Bank Harmonic Filter for WAG-9H, WAP-7 and WAP-5 of 25 kv, 50 Hz AC locomotives

2.0 CLIMATIC AND ENVIRONMENTAL CONDITION:-

* Maximum Atmospheric Temperature : +70ºC (in sun) & +50ºC (in shade)
* Humidity : 100% saturation during rainy season.

* Reference Atmospheric Temperature
  - i) Ambient temperature : max +47ºC, min +0ºC
  - ii) Humidity : 60%
  - iii) Altitude : 160m above mean sea level.
  - iv) Rain fall : Very heavy in certain areas. The locomotive will be designed to permit its running at 10Km/hr in flood water level of 102mm above rail level.

* Atmosphere during hot weather : Extremely dry and desert terrain in certain areas.

* Coastal Areas : Locomotive and equipment will be designed to work at coastal areas in humid and salt latten areas.

* Vibration : The equipments, sub-system and their mounting arrangement will be designed to withstand vibrations and shocks as specified in corresponding IEC publication unless otherwise prescribed.

3.0 STANDARD

IEC 61071-1, IEC 68, EN 61071-1, VDE 560-120, IS: 11731(Part I&II)

4.0 TECHNICAL DATA

CHARACTARISTICS:

- Capacitance (Cn, TOL) : 66.6 µF ± 5%
- Rated Voltage (Un, ac) : 2500V
- RMS Voltage (Urms) : 1800V
- Rated Insulation Voltage (Ui) : 2200V
- Rated Current (In) : 80A
- Self-Induction (Lself) : 450 nH
- Di-electric Dissipation factor ($\tan\delta_{0)}$: 2×10^{-4}
- Service Resistance (Rs) : 1.9 mΩ
- Self-discharge time constant (Risc) : 210000S
- Dissipation factor tanδ (SoHz) : $\leq 3 \times 10^{-4}$

DRN. CHKD. AEE/SEE

SPECIFICATION FOR CAPACITOR BANK HARMONIC FILTER FOR WAG-9H, WAP-7 AND WAP-5 LOCOMOTIVES	DY. CEE/D-II	CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL, INDIA. NO. CLW/ES/3/SK-1/0664 DATE:

MAXIMUM RATINGS

- Repetitive peak voltage (U) : 3100V
- Non-repetitive peak voltage surge (Us) : 4300V
- Repetitive peak current (I) : 16KA
- Non-repetitive peak current Surge (Is) : 40KA
- Rate of voltage rise repetitive $(du/dt)_{max}$: 240V/µs
- $(du/dt)_s$: 600V/µs

DESIGN DATA

- Dimension : Dia. 178.5mm X 500mm
- Approx. weight : 10Kg
- Impregnation : Protective gas (SF6)
- Terminations : Screw terminals M12
- Max. torque :10Nm
- Terminal cross section : $16mm^2$
- Creepage distance : 90mm
- Clearance over pressure dis-connector : 40mm

5.0 DESIGN AND CONSTRUCTIONAL DETAILS:

CONSTRUCTION:

- Self-healing
- Two layers of metallized polypropylene film
- Metal sprayed face ends for reliable contacting
- Cylindrical aluminium case
- 2- pole version, ceramic lead throughs
- Mounting bolts M12
- The capacitor should have high di-electric strength, high peak current capability for damping and commutation in upper frequency range.

ELECTRODE

Two layers of metallized polypropylene film will form the electrode.

DI-ELECTRIC

Two layers of metallized polypropylene film.

SELF-HEALING

Breakdowns can occur under heavy electrical load as a result of weaknesses or pores in the di-electric. The integrity of self-healing capacitors should not be affected by such breakdowns.

When a breakdown occurs, the di-electric in a breakdown channel is broken down into its atomic components by the electric arc that forms between the electrodes. At the high temperatures of as much as 6000K, a plasma is created that explodes out of the channel and pushes the di-electric layers apart. The actual self-healing process starts with the continuation of the electric arc in the propagating plasma where the metal layers are removed from the metal edges by evaporation. Insulation areas are formed. The rapid expansion of the plasma bond the areas of insulation and its cooling in the areas of less field strength allow the discharge to extinguish after a few micro seconds.
The areas of insulation that is created is highly resistive and voltage proof for all operating requirements of the capacitor. The self-healing breakdown is limited in current and so, it does not represent a short circuit. The self-healing process is so brief and low in energy that the capacitor also remains fully functional during the breakdown.

IMPREGNATION:

All the gaps between the windings and the case are filled with SF6 gas which increases the di-electric strength and free from fire hazard. The impregnating agent should be pure and free from oxidizing agent.

CONTACTING:

The end faces of the windings should be contacted by metal spraying to ensure a reliable and low inductance connection between the leads and layers. The leads should be welded or soldered to these end faces, brought out through insulating elements(ceramic or plastic) and soldered to the terminals.

SAFETY FOR OVER LOAD AND FAILURE:

This self-healing capacitor should be fitted with an over pressure dis-connector. This will prevent the capacitor from bursting if the pressure inside it becomes too high through over loading or at the end of its service life.
The excess internal pressure either expands the folded crimps on the aluminium case or pushes the bottom of the case outwards or the diaphragm.
The die-connector is separated at its break point and the current to the windings in the capacitor is interrupted.

MOUNTING ARRANGEMENT

Mounting arrangement is shown in DRG. No. CLW/ES/3/SK-2/0664 which is within the scope of supply.

6.0 TESTS

Test protocol for prototype test and routine test shall be as mentioned as per IEC 61071 in Table 1 below:

Table 1

Sl.No.	Kind of Test	Clause	
		Type Tests	Routine Tests
1.	Dimensional checking	Yes	Yes
2.	Capacitance measurement	Yes	Yes
3.	Mechanical test	Yes	----
4.	Sealing test	Yes	Yes
5.	Voltage test between terminals	Yes	Yes
6.	Voltage test between terminals and case	Yes	Yes
7.	Surge discharge test	Yes	-----
8	Self healing test	Yes	-----
9	Environmental testing	Yes	-----
10	Measurement of the tangent of the loss angle ($\tan\delta$)	Yes	Yes
11	Thermal stability test	Yes	-----
12	Test of internal discharge device	Yes	Yes
13	Resonance frequency measurement	Yes	-----
14	Endurance between terminals	Yes	-----
15	Destruction test	Yes	----

DI-ELECTRIC STRENGTH TEST

Across terminals V_{TT}

Testing of di-electric strength across the terminal is conducted at 3800V AC, at 50Hz for 10sec.as a routine test at room temperature. The capacitors are designed so that tests may be repeated once, at room temperature with 80% of the test voltage.

TERMINAL TO CASE V_{TC}

Testing of di-electric strength between terminals and case is conducted at 6000V AC at 50Hz for 60 sec. as a routine test at room temperature. The capacitors are designed so that the tests stated may be repeated at room temperature.

MECHANICAL TESTS

VIBRATION RESISTANCE TEST

The resistance should be checked as per IEC 68 part 2-6 because of the possible influence of fixing and the connections on the resonant properties, it is necessary to check stability when a capacitor is build and exposed to vibration.

SHOCK TESTING:

This is carried out in accordance with IEC 68 part 2-27.

SOLDERING CONDITIONS:

This capacitor should satisfy the conditions as per IEC 68, part 2-20.

Solderability : (275±10)ºC, (2±0.5)S

Heat resistance : (350±10)ºC, 5S

When soldering their terminations, make sure capacitors are not damaged through excessive heat. This means:

-Lead wires with a cross section greater than 1.5 mm^2 should not be soldered but clamped (soldering would require too much heat).

-Do not solder at spots where heat concentrates, otherwise there is a risk of solder tags being soldered up (melting).

FLAMMABILITY TEST:

Flammability test of non-metallic parts of Capacitor Bank Harmonic Filter should be carried out as per IS: 11731 Part(I & II).

7.0 DOCUMENTS TO BE SUPPLIED BY THE TENDERER

The tenderer shall furnish the following in 3 copies alongwith the quotation.

i) Clause wise comments on the specification and test programme.

ii) Detailed drawings

iii) Past experience with supporting papers (if any).

iv) Past test reports (if any).

8.0 TECHNICALDOCUMENTS TO SULLIED BY THE SUPPLIER:

The following documents shall be supplied by the supplier as a part of the contract.

i) Type test reports – 10 copies.

ii) Routine test report along with each set – 4 copies.

iii) Maintenance manual -20 copies.

iv) Detailed drawings – 6 copies.

9.0 QUALITY ASSURANCE:

Quality assurance should be as per ISO: 9000.

10.0 REFERENCE:

TYPE: B 25990W7666J**W

Schematic position: 8.4, Q/L: 2 Nos. (for WAP-5), Q/L: 6 Nos. (Consisting of six individual capacitors) (for WAG-9).

NOTE:

i) The tenderer should confirm that the item is similar to the item which has been used for WAG-9 class of electric locomotives manufactured by M/s ABB for Indian railways.

ii) The tenderer shall fix name plate on the equipment indicating.

iii) Manufacturer name and also monogram /brand.

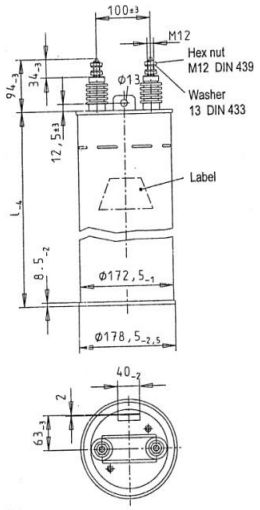
iv) Range of electrical ratings in watts.

v) Max. rated voltage

vi) Month & Year of manufacture(E) Sl.no. of equipment

Sheet-

DIMENSIONAL DRAWING OF 66.6µF CAPACITOR



Dimensions in mm

Design data

Dimensions Ø x l	178.5 x 500 mm
Approx. weight	10 kg
Impregnation	Protective gas

DRN.	CHKD.	AEE/SEE	SPECIFICATION FOR CAPACITOR BANK HARMONIC FILTER FOR WAG-9H, WAP-7 AND WAP-5 LOCOMOTIVES	DY. CEE/D-II	CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL, INDIA. NO. CLW/ES/3/SK-1/0664 DATE:

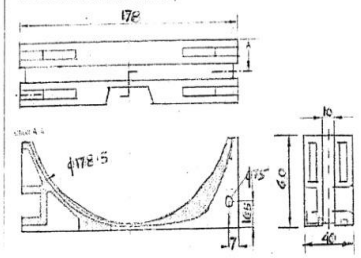
DRN. CHKD. AEE/SEE
SPECI
CAPA
HARM
FOR WAG-9H, WAP-7 AND WAP-5 LOCOMOTIVES
DY. CEE/D-II
NO. CLW/ES/3/SK-1/0664
DATE:

Sheet-

MOUNTING PARTS

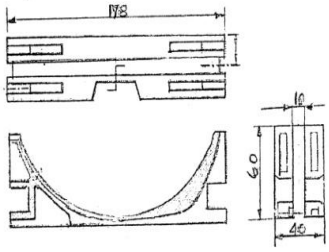
Half Shells For Capacitor 178.5 mm in diameter

Front Half Shell with End Stop

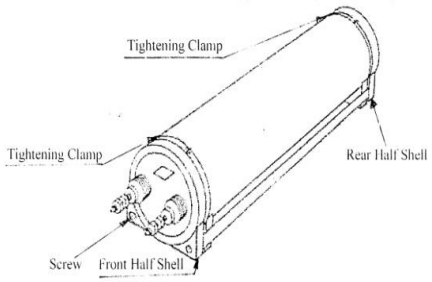


Half Shells For Capacitor 178.5 mm in dia

Rear Half Shell without End Stop



Half Shell (semicircular supports) and Tightening Clamps



DRN.	CHKD.	AEE/SEE	SPECIFICATION FOR CAPACITOR BANK HARMONIC FILTER FOR WAG-9H, WAP-7 AND WAP-5 LOCOMOTIVES	DY. CEE/D-II	CHITTARANJAN LOCOMOTIVE WORKS WEST BENGAL, INDIA. NO. CLW/ES/3/SK-2/0664 DATE:

DRN. CHKD. AEE/SEE
SPECI
CAPA
HARM
FOR WA
WAP-5