

1.1 MARK 1 HEATING SYSTEM

1.1.1 General Description

The system uses a series of external heating harnesses to provide a total load of 12.5kW. Independent harnesses are fitted to the lower half of the tank both along its length and on the dome shaped ends. Particular attention is given to the region of the suction outlet. The heating harness arrangement provides for a uniform heat distribution and a total coverage of approximately 40% of the tank surface.

The heating cable is constructed from 60/16 NiCr. Wire and insulated with silicone rubber with a continuous withstand capability of $\pm 200^{\circ}\text{C}$.

Two control boxes are fitted, which between them contain:

- Mains ON-OFF switch (SW1)
- Voltage selection switch (SW2)
- Supply voltage neon indicator (L1,L2)
- Heat ON neon indicator (L3)
- Heating element circuit breakers (CB1-7)
- Controlling Thermostats (TH1, TH2)

The change from 440V (star connected) to 220V (delta connected) supply is effected by changeover switch SW2. **Note: ON/OFF switch SW1 must be in OFF position before operating voltage selector switch SW2**

Heating zones connected to each phase are protected by circuit breakers (CB1-6).

Temperature control is achieved by means of two thermostats:

TH1 controls the element temperature
TH2 controls the cargo temperature

The thermostats have a switching accuracy of 1.%.%

Interconnections between the control boxes and the heating harnesses, are standard MSS-C trace heating tape cold leads.

The cold leads are similar to the heating cable except that the conductors are constructed from Ni. plated Cu.

Supply cable is:

- 4 core 6mm² stranded EPR insulated PCP sheathed cable. (Length 8m)

1.1.2 Inspection Procedures

Control Box Exterior

On visual inspection, check that:

The boxes are secure, watertight and free from damage and:

- Doors function correctly
- Door seals are in good condition
- Door fasteners function correctly
- Neon indicators are secure
- Cable glands are correctly fitted
- Thermocouple conduit seals are intact
- Decals are fitted and legible
- Earth connection is secure

Control Box Interior

Check that the interiors are free from signs of:

- Overheating
- Corrosion
- Damage
- Moisture ingress

in the lower part of the box, by adjusting the quick release fasteners.

Ensure that:

- All components are present and secure
- Electrical connections are tight
- Perspex covers are fitted
- Decals are present and legible

Heating Elements

Heating harness cold leads MSS-C are secure and free from damage.

Glands are fitted and watertight.

1.1.3 Insulation Resistance Test

Note: This test should be carried out using a 500V insulation resistance tester.

Ensure that the unit is disconnected from the mains supply.

Test earthing integrity by checking continuity between the tank frame and terminal E.

Ensure that SW1 and circuit breakers CB1-7 are in the 'ON' position.

Test insulation between:

Earth and terminals L1, L2 and L3.

Note: Tests should give readings in excess of 1 M Ω . If less, refer to repair section.

1.1.4 Heating Element Continuity Test

Ensure that the tank electrics are disconnected from the mains supply.

Open the control box 'B' and remove the perspex protection plate, fitted over the terminal block

Remove connections from the outlet side of terminals numbered 14, and check each connection for continuity with terminal no. 15, using a multi-meter. Each resistance should be approx. 30 ohms \pm 10%.

Repeat the above procedure for terminal no.'s 16 and 17 respectively.

Repeat the above procedure for terminal no.'s 18 and 19 respectively.

1.1.5 Function Test

Connect the supply cable to terminals L1, L2 and L3 in the control box 'A'.

Select correct voltage by switching SW2 to 220V or 440V.

Set thermostats TH1 and TH2 to a temperature above ambient.

Switch on the mains supply at source.

Switch SW1 in control box 'A' to the 'ON' position.

Neon indicator L1 or L2 should light according to the supply voltage.

Neon indicator L3 should light.

Using a tong test ammeter measure the current drawn on each phase of the incoming supply.

All three readings should be approximately equal. Typical line currents are:

- 380/440V - 19 Amps max, 16 Amps min.
- 220/240V - 29 Amps max, 26 Amps min.

Turn TH1 to '0' position - no line currents are drawn. No reading on the tong tester. L3 not lit.

Set TH1 back to above ambient and TH2 to '0' position. No reading on the tong tester. L3 not lit.

Reset TH1 and TH2 to required setting (refer to operating decal on door front).

1.1.6. Repairs

Earth Faults

When the insulation test shows no continuity between panel Earth and frame, check presence and contact of earthing wire between the control boxes and terminal welded to ISO framework.

Repair/replace as required.

When the insulation test is unsatisfactory, remove connecting wires from terminal block in panel and test between wires 15, 16, 18 and Earth, if now satisfactory the fault is in the control box.

Locate and rectify.

Harness Insulation Faults

When the insulation check fails to give the correct result the location of the fault can be found as follows:

Ensure switch SW2 is in the 440V position.

Disconnect the wires from the outgoing side of circuit breakers CB2, CB3 & CB5.

To identify the faulty harness element, carry out insulation tests between the following terminals and Earth:

16 to Earth - Harness H1 and H5

18 to Earth - Harness H2 and H4

15 to Earth - Harness H3 and H6

In the event of no short circuit being found in the individual harnesses, the fault lies in the high voltage wiring within the control boxes.

Check for loose wires and burnt out switches.

Where only one circuit is found to be down to Earth, the tank may be used at reduced power input by proceeding as follows:

Having identified the faulty element, fold back the element cold lead and insulate the ends by fitting into a suitable loose connection block - cover with insulation tape and secure to adjacent cables to prevent the loose cable causing further malfunction.

Re-connect all remaining cables and carry out a total electrical insulation test (See 1.1.3).

Replace perspex safety cover and close the control box door.

Where element down to Earth is to be repaired, check the harness location, disconnect all wiring to that harness at the control box. Check for element damage and either repair locally or replace. Consult Mannings for detailed instructions.

External Harness Heating

Where a heating element continuity fault is identified under testing (para. 1.1.4) proceed in the same manner as a fault determined by the insulation test by operating at reduced power, or replacement/repair.

External Heating System

Supplied as six discrete harness assemblies complete with harness cold leads.

Order as heater circuits 1042621/H1...H6.

- Operating instructions Ref. 107915
- Circuit diagram Ref. 107916
- Refer also to spares list section