

## **TECHNICAL SPECIFICATIONS OF STATOR CORE HEATING INSTALLATION**

### **1. PURPOSE :**

Stator Core Heating Installation is required for heating stator core of turbo generator during assembly for pressing/ consolidation.

### **2. SCOPE :**

The scope of supply includes design, manufacturing, testing, supply, installation & commissioning of heating Installation at BHEL Hardwar.

### **3. TECHNICAL SPECIFICATION :**

3.1 The general arrangement dimensions and broad specifications of the equipment will be as per enclosed BHEL drawing No. R7709.0090.

3.2 Heating Installation Capacity: 164.5 kW continuous or more.

Blower Capacity : 1.5 M<sup>3</sup> / Sec or more.

Motor Capacity : 10 H.P. or more

Working temperature : 160<sup>0</sup> C or more at the outlet of the heating installation.

3.3 The Stator Core Heating Installation will have 144 nos. Heating Elements of equal power rating, preferably made out of Incoloy tubing filled with electro-fused Magnesium Oxide densely compacted. The element will be of "U" shape with nipple & nut at both ends for easy mounting on the Installation. The length of "U" Bend will be 350 mm approx. and will be shaped suitably as shown in the drawing so that it can be easily accommodated in the housing and heat dissipation will also be effective. Vendor to specify No. of heating elements and power rating of each element.

3.4 The fabricated body of the Installation will be made out of 10 Gauge sheet steel, and will be hexagonal in shape with 410 mm face dimension as per drawing. Six hexagonal Installations will be made out of channel section of 80 x 30 x 30 mm of 10 Gauge sheet. Six numbers of these hexagonal cakes will be stacked one above the other to form one hexagonal Installation when welded at the joints. The mounting holes of the elements will be on two faces opposite to each other on each of the six hexagonal cakes. The mounting faces are termed as A-B-C-D-E-F and A', B', C', D', E', F'. Each housing can be joined with each other with 24 holes provided on the extended edges (30mm) of the channel section as shown in the drawing R7709.0090 with suitable fasteners.

3.5 The base of the Installation will have a round plate of dia 690 x dia 550 x 12 mm thick with 8 holes of dia 18 equally spaced at pcd 640mm. The height of 280mm shown in the drawing at the bottom of hexagonal Installation will be covered with 10 Gauge sheet steel and hexagonal opening will be reduced to dia 550mm by the above sheets tapered to desired angle. Reinforcing ribs (3/8" thick) of suitable size will also be provided to avoid buckling of the Installation. Hexagonal Installation and bottom housing will be joined through a 50 x 50 x 6 mm angle as per drawing.

3.6 Top most part of the heating Installation will accommodate axial flow fan capable to deliver 1.5m<sup>3</sup> per second of air. The fan motor will be of reputed make like Siemens, Crompton, Bharat Bijlee, ABB with class F insulation suitable to operate continuously at full load. Supplier to indicate make of the motor. The fan motor shall be protected by suitable motor protection circuit breaker. The axial flow fan will be dynamically balanced for trouble free and smooth operation. The motor will be coupled directly such that there will be a 12 mm thick plate between motor and fan. The plate will have mounting holes to match with fixture available at BHEL Hardwar. Also refer drg no. R7709.0090.

The top plate as per BHEL drawing will be provided with suitable adequate lifting arrangement with crane. The body of the Heating Installation will be safe for 250 Kgs., load.

#### **4. CONNECTION ARRANGEMENT OF ELEMENTS:**

The heating Installation will be divided into 2 equal stages operating at 415 V, 3 phase, 50 Hz A.C. supply. For each stage max 3 nos. cable lugs and terminals will be provided on heater Installation body for the elements. Leads of motor will be detachable. All power cables wiring shall have lugs and terminal type connection arrangement at both ends.

The stage wise connections are made such that for both the stages the inside cavity of the Installation is evenly heated and thus, maximum heat efficiency is achieved and over burning of element due to intermittent heating is avoided. All the terminals will be numerically indexed at the Installation as well as on the panel equipment for easy connection / disconnection. To facilitate the above, 20 metre long cordage having matching cable lugs at both ends with 3 core cable will also be provided for all the terminals. The rating of the cable will be good enough to avoid over-heating during continuous use. All cable lugs/ terminals for heater Installation will be mounted on top plate.

**NOTE :** To avoid sparking between plug and sockets during operation termination using cable lug & terminals shall be preferred. The size of the cable lug used in the earthing wire should be of different size to avoid wrong connection. The heaters should be placed such that no short circuiting takes place between two heaters due to less space.

#### **5. CONTROL EQUIPMENT:**

The heating temperature will be controlled with phase angle controlled thyristorised power controllers & PID controller, in two equal stages. The PID controller should have user friendly temperature setting system.

The control equipment will be of cubical pattern of approximate size 1500 x 900 x 1400 mm height, with trolley wheels at the bottom. The outlook will be as per BHEL Drg. No. R7709.0090.

The control equipment will be suitable for 415V, 3 phase, 50 Hz, 3 wire system without neutral supply, housed in a 16/18 Gauge sheet steel duly painted with suitable ventilation slits and exhaust fan of suitable capacity for effective cooling inside the cabinet. The control equipment shall be completely wired up, ready for operation. The supply will be routed through a switch fuse unit and ammeters, voltmeter and with adjustable over-current range.

The fan motor control protective gears will be electrically inter-locked in such a way that heater circuit will not start unless the fan is on 'ON'. This is to prevent the failure of elements in absence of air flow. This precaution is essential as the wattage density of the element is too high (164.5 kW or more) in a comparatively small housing.

The main switch fuse unit feeds the supply to Bus-bars. From Bus-bar, supply is fed to two stages, each at 415 V, 3phase, through power controller. From power controller, power reaching to distribution Bus-bars and bus-bar in turn, will supply power to industrial terminals, numerically indexed on the panel. The terminals will be mounted on the either side of the panel.

The panel will have following control accessories:

Key switch lockable to control mains.

1. On-Off push button for fan motor control.
2. ON- Off push buttons for mains and all the stages.
3. Pilot lamps, for mains, fan motor blower and all the stages.
4. Two Nos. PID temperature controllers with suitable RTDs
5. Two Nos. 6 points microprocessor based temperature recorders range (0-250 deg C) with 180mm chart width.

2 RTDs for 2 stages (one for each stage) will be provided with 20 meter long compensating cable. These RTDs will be fitted at heater unit outlet and will act as sensor for PID temperature controllers. These RTDs will be permanently connected through quick connecting plugs mounted on panel. Both the 6 point temperature controller and temperature recorder shall be complete with 6 nos. RTDs with lead assemblies. Both the instruments will be of reputed make complete with thermocouple lead assemblies, vendor to indicate the make of these instruments.

RTD connecting cables shall be suitably protected with flexible metallic conduit. Panel will be most versatile and having access for repair, maintenance or rectification. Enough storage facility for housing connection cordages will be there while equipment is not in use. The panel will have proper illumination inside with a suitable CFL.

**6. SOURCE OF ELECTRIC SUPPLY :**

The equipment shall be suitable to operate at 415+/-10% V, 50+/-3% Hz, 3 phase, 3 wire system. BHEL will provide this power supply to incoming of control panel. All other cablings are in the supplier's scope of supply.

**7. ENVIRONMENTAL CONDITION :**

The equipment shall be suitable to operate at ambient temperature from 0<sup>0</sup> C to 45<sup>0</sup> C and relative humidity upto 95%.

**8. INSTALLATION AND COMMISSIONING :**

The supplier shall be fully responsible for installation and commissioning of the Heating Installation and its controls at our plant.

**9. SPARES (OPTIONAL) :**

Spares required for 2 years trouble free operation are to be quoted separately, giving description, quantity and price of each item separately. Spares should also include heaters, power controller & control card.

**10. DOCUMENTS :**

5 Sets of operation and maintenance manuals including various circuit diagrams shall be supplied free of charge along with the equipment. In addition to operation and maintenance instructions these manuals shall also include following information :

- Layout drawing with foundation details & design drawings.
- Names of manufactures, type, rating. capacity of electric drives, switch-gear, meters, controllers, thermocouples and instruments all with printed literature.
- Test certificates for motors switch-gear etc .
- Final circuit diagrams with proper wire numbers including circuit diagram of PCB.
- Service requirements including incoming cable size.
- Complete list of all spare parts with item wise price, their make, specifications and identification no.
- Laying and wiring diagram of heaters.

**11. PAINTING :**

Control panel etc. shall be painted to shade apple green as per IS:5.

**12. PRE-DESPATCH INSPECTION :**

The Heating Installation will be inspected by BHEL representative at suppliers' works prior to despatch, including trial operation.

**13. GUARANTEE :**

The Stator Core Heating Installation shall be guaranteed for 24 months after successful commissioning of the equipment at BHEL works.

**14. PACKING :**

Various assemblies shall be suitably packed to prevent damage during transit and storage. All the surfaces shall be properly conserved before despatch.

**15. GENERAL :**

Supplier to give various details like make, model and specifications of various bought out items, circuit diagram and complete details of the equipment quoted, in their offer.

## **16. QUALIFYING CONDITIONS :**

Only those vendors (OEMs), who have supplied and commissioned at least one Stator Core Heating Installation for similar application and Heating capacity of 120KW or more in the past ten years (on the date of opening of Tender ) and referred equipment is presently working satisfactorily for more than one year (on the date of opening of Tender ) after commissioning, should quote. However, if referred equipment (s) has/had been supplied to BHEL, then the equipment should be presently working satisfactorily for more than six months (on the date of opening of Tender ) after its commissioning and acceptance in BHEL. The following information should be submitted by the vendor about the companies where referred equipment (s) have been supplied. This is required from all the vendors for qualification of their offer.

- 16.1 Name of the customer / company where referred equipment is installed.
- 16.2 Complete postal address of the customer.
- 16.3 Month & Year of commissioning.
- 16.4 Parameters of equipment(s) supplied ( Heating capacity, Air discharge rate & design details ) and application for which the equipment is supplied
- 16.5 Name and designation of the contact person of the customer.
- 16.6 Phone, FAX no. and e-mail address of the contact person of the customer.
- 16.7 Performance certificate from the customers regarding satisfactory performance of equipment supplied to them (Original Certificate or Through E-mail directly from the customer). The original performance certificate may be returned after verification by BHEL, if required.
- 16.8 BHEL reserves the right to verify information submitted by vendor. In case the information is found to be false / incorrect, the offer shall be rejected.

(Bk-1 Mech. Maint.)      (Bk-I Elec. Maint.)      (Bk-I CNC Maint.)      (LSTG Iron Assly)      (EMT)