



**Bharat Heavy Electricals Ltd**  
**Boiler Auxiliaries Plant**  
**Ranipet-632 406**

**EDC/GATES & DAMPERS**

**INDEX SHEET FOR SEAL AIR  
DUCT HEATER**

**SPECIFICATION No. GDRS: 031**

**REV NO:00**

**PROJECT: NTPC Barh stage-1, 3 x 660 MW**

**INDEX SHEET - Seal Air Duct Heaters for NTPC Barh stage-1, 3 x 660 MW project**

| Sl. No. | Item Description                                                                          | Document Reference         | No. of pages | Rev. no. |
|---------|-------------------------------------------------------------------------------------------|----------------------------|--------------|----------|
| 1       | Technical Specification for Seal Air Duct Heater                                          | GDRS: 031                  | 6            | 00       |
| 2       | General Arrangement Drawing for Seal Air Duct Heater (149 KW) for FGD Outlet Gate         |                            | 1            | 0        |
| 3       | General Arrangement Drawing for Seal Air Duct Heater (525 & 305 KW) for FGD Bypass Damper |                            | 1            | 0        |
| 4       | Schematic showing the seal air system for Gate / Damper with Heater                       | 4-57-999-25173             | 1            | 00       |
| 5       | Instrument Data Sheets for Seal Air Duct Heater                                           |                            | 3            | 01       |
| 6       | Seal Air Duct Heater Inspection and Test Procedure                                        | G&D-Duct-Htr-ITP-001       | 4            | 01       |
| 7       | Format for Test Report – Dimensional                                                      | G&D-Duct-Htr-Report-Dim    | 1            | 0        |
| 8       | Format for Test Report – Electrical                                                       | G&D-Duct-Htr-Report - Elec | 1            | 0        |

|     |            |               |                  |                    |
|-----|------------|---------------|------------------|--------------------|
| 01  | 07.08.2019 | Fresh Release | MANU ALEX THOMAS | D. ASHWIN DHINAKAR |
| REV | DATE       | DESCRIPTION   | PREPARED         | APPROVED           |

|                                                                                   |                                                                                                  |                                                                                                     |  |
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|  | <b>Bharat Heavy Electricals Ltd</b><br><b>Boiler Auxiliaries Plant</b><br><b>Ranipet-632 406</b> | <b>EDC/GATES &amp; DAMPERS</b><br><b>TECHNICAL SPECIFICATION FOR</b><br><b>SEAL AIR DUCT HEATER</b> |  |
| SPECIFICATION NO: GDRS: 031                                                       | REV NO:00                                                                                        | PROJECT: NTPC Barh stage-1, 3 x 660 MW                                                              |  |

## Seal Air Duct Heaters for Barh stage-1, 3 x 660 MW project

### 1.0 SITE CONDITIONS:

The Seal Air Electric Heater shall be designed taking care of the following site conditions.

| Sl. No. | Particulars                |                                                                                                                          |
|---------|----------------------------|--------------------------------------------------------------------------------------------------------------------------|
| 1.1     | Ambient temperature        | 5 deg. C to 50 deg. C                                                                                                    |
| 1.2     | Design ambient temperature | 27 deg. C                                                                                                                |
| 1.3     | Relative humidity (max.)   | 100 % RH                                                                                                                 |
| 1.4     | Environment                | Highly polluted, abrasive dust. Climate is tropical and conducive to fungus growth.                                      |
| 1.5     | Location                   | The Heater Assembly portion is kept in outdoor location on top of duct. The terminal box is kept at ambient temperature. |

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| SPECIFICATION NO: GDRS: 031                                                       | REV NO:00                                                                                        | PROJECT: NTPC Barh stage-1, 3 x 660 MW                                                              |  |

## 2.0 CONSTRUCTIONAL FEATURES OF SEAL AIR (DUCT) HEATERS – SPECIFIC TO NTPC Barh stage-1, 3 x 660 MW PROJECT.

2.1 The Heater KW rating required & quantities for the different services shall be as indicated below:

| Sl. No. | Unit No (BHEL Cust no)   | FGD Outlet gate                                                                                                                                                                     | FGD Bypass damper                                                                                                                                                                                  | Cable size details                                                                                                                                                                                               |
|---------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Unit-1 660 MW FGD (G604) | 149 KW rating<br>149 KW in single Heater bank<br>2 nos. Heaters ( 1 working + 1 standby)<br>( Air flow through working heater : 48.8m <sup>3</sup> /min, Temp rise : 5°C to 130°C ) | 525 KW rating<br>525 KW to be split in 3 equal Heater banks<br>2 nos. Heaters ( 1 working + 1 standby)<br>( Air flow through working heater : 180.2m <sup>3</sup> /min, Temp rise : 5°C to 130°C ) | <b>Cable size for each heater bank</b> is 3C-150 sq.mm Copper XLPE FRLS, 1 cable run for each working & standby heaters for 149 KW rating & <b>3 cable runs for each 525 KW rating</b> Working & standby heaters |
| 2       | Unit-2 660 MW FGD (G605) | Same as in sl. No.1 above                                                                                                                                                           | Same as in sl. No. 1 above                                                                                                                                                                         | Same as in sl. No. 1 above.                                                                                                                                                                                      |

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**Boiler Auxiliaries Plant**  
**Ranipet-632 406**

**EDC/GATES & DAMPERS**  
**TECHNICAL SPECIFICATION FOR**  
**SEAL AIR DUCT HEATER**

**SPECIFICATION NO: GDRS: 031**

**REV NO:00**

**PROJECT: NTPC Barh stage-1, 3 x 660 MW**

|   |                          |                                                                                                                                                                                            |                                                                                                                                                                                                        |                                                                                                                                                                                                                  |
|---|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3 | Unit-3 660 MW FGD (G606) | 149 KW rating<br>149 KW in single Heater bank<br>4 nos. Heaters ( 2 working + 2 standby)<br><br>( Air flow through each working heater : 51m <sup>3</sup> /min, Temp rise : 5°C to 130°C ) | 305 KW rating<br>305 KW to be split in 2 equal Heater banks<br>4 nos. Heaters ( 2 working + 2 standby)<br><br>( Air flow through working heater : 105.8m <sup>3</sup> /min, Temp rise : 5°C to 130°C ) | Cable size for each <b>heater bank</b> is 3C-150 sq.mm Copper XLPE FRLS, 1 cable run for each working & standby heaters for 149 KW rating & 2 cable runs for each <b>305 KW</b> rating Working & standby heaters |
|---|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

**Each Heater Bank should be connected in 3 Phase, 3 Wired Delta connection.**

2.2 Permissible variations in electrical parameters are 415 V  $\pm$  10 % and 50 Hz  $\pm$  5 % & Combined variation  $\pm$ 10 % (Absolute sum).

2.3 Terminal Box Material shall be FRP.

2.4 Minimum Clearance from the Terminal Box lid to the live terminals shall be 19 mm. Other electrical clearances shall be as per relevant standards.

2.5 Cable glands shall be fixed with dummy plugs.

2.6 The Terminals Box shall meet IP-55 degree of protection as per IS / IEC-60947.

2.7 Terminals Box GA (General Arrangement) & Manufacturing drawing shall be submitted for approval.

2.8 Paint shade for Terminal Box shall be RAL – 7032.

2.9 Supply/ Cable Size ( Refer Table 2.1 above )

|            |             |                    |                  |                    |
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| <b>SPECIFICATION NO: GDRS: 031</b>                                                | <b>REV NO:00</b>                                                                                 | <b>PROJECT: NTPC Barh stage-1, 3 x 660 MW</b>                                                       |  |

2.10 Deleted ( for this project ).

~~2.11 Cable size & type will be furnished by our customer. BHEL will in turn inform the vendor before or after placement of Purchase Order. This shall than be incorporated in the vendor's Power Junction Box drawing and suitable cable glands and lugs shall be provided by vendor without any price implication.~~ (Refer Table 2.1 above )

2.12 Vendor shall furnish details of type of control (i.e. thermostat) and mounting location for this along with offer. Power supply Panel and controls like contactor will be in BHEL scope. However provision for ON-OFF control to be provided by vendor.

2.13 All the Instruments for Sensing and Protection of Heater shall be wired to Instrument Terminal Box (JB) by vendor. The wiring diagram shall be submitted to BHEL for approval. This is required for wiring from TB/JB to DCS. This Instrument Terminal Box shall be mounted on the Heater. This shall be suitable to receive appropriate nos. of 2C- 2.5 sq. mm stranded copper, PVC insulated FRLS, unarmoured cables.

2.14 No Asbestos material shall be used in any of the heater components.

2.15 Name Plate (engraved chromium plated) shall be provided on the Heater indicating manufacturer's Name, KW rating, Model number, Voltage grade, Serial Number, Name of the equipment, Resistance value and BHEL Purchase Order Reference Number.

2.16 The offer shall indicate detailed Bill of Materials as per Enquiry. During delivery, the supply of the materials- type, quantity, rating etc. shall be strictly in line with the bidder's final offer accepted by BHEL and shall be in line with the order.

2.17 The proposed Heater model shall operate seamlessly (by means of a Thermostat). When the temperature touches 130 deg. C, it shall trip and when the temperature falls to about 125 deg. C, it shall restart. The start and trip set points shall be field adjustable.

|            |             |                    |                  |                    |
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| <b>SPECIFICATION NO: GDRS: 031</b>                                                | <b>REV NO:00</b>                                                                                 | <b>PROJECT: NTPC Barh stage-1, 3 x 660 MW</b>                                                       |  |

2.18 The design of heating elements (and seal air heater), shall take into account necessary safety factor. Tube shall be SS321. The tubular heating elements shall be Nichrome ( Ni-Cr). The filling material inside heating tubes shall be Magnesium Oxide ( MgO). The heater shall be provided with mineral wool insulation.

2.19 The heaters shall have minimum design life of 25 years, and shall be able to withstand the thermal cycling as well as dynamic forces such as vibration etc.

2.20 All ferrous parts shall be adequately rust protected.

2.21 All bolts, nuts, washers and other terminals shall be nickel plated to avoid rusting.

### 3.0 INSPECTION AND TESTING

The heating element shall be inspected and tested based on the following documents.

1. BHEL Purchase order.
2. BHEL Technical Specification.
3. BHEL Quality CHECKLIST.
4. BHEL Approved supplier drawings for heaters and packing.

### 4.0 PACKING

4.1. Each Heater Assembly shall be packed in a crate. Lining with plastic / water-proof sheet shall be provided inside the crate packing to eliminate water entry during transit/ storage.

4.2. Required quantity of silica gel shall be provided in packing to prevent moisture ingress.

### 5.0 Details to be furnished by vendor along with Technical offer & Unpriced Bid:

5.1. G.A. drawing & Datasheets of Heater ( each type) with all details required as per BHEL technical specification.

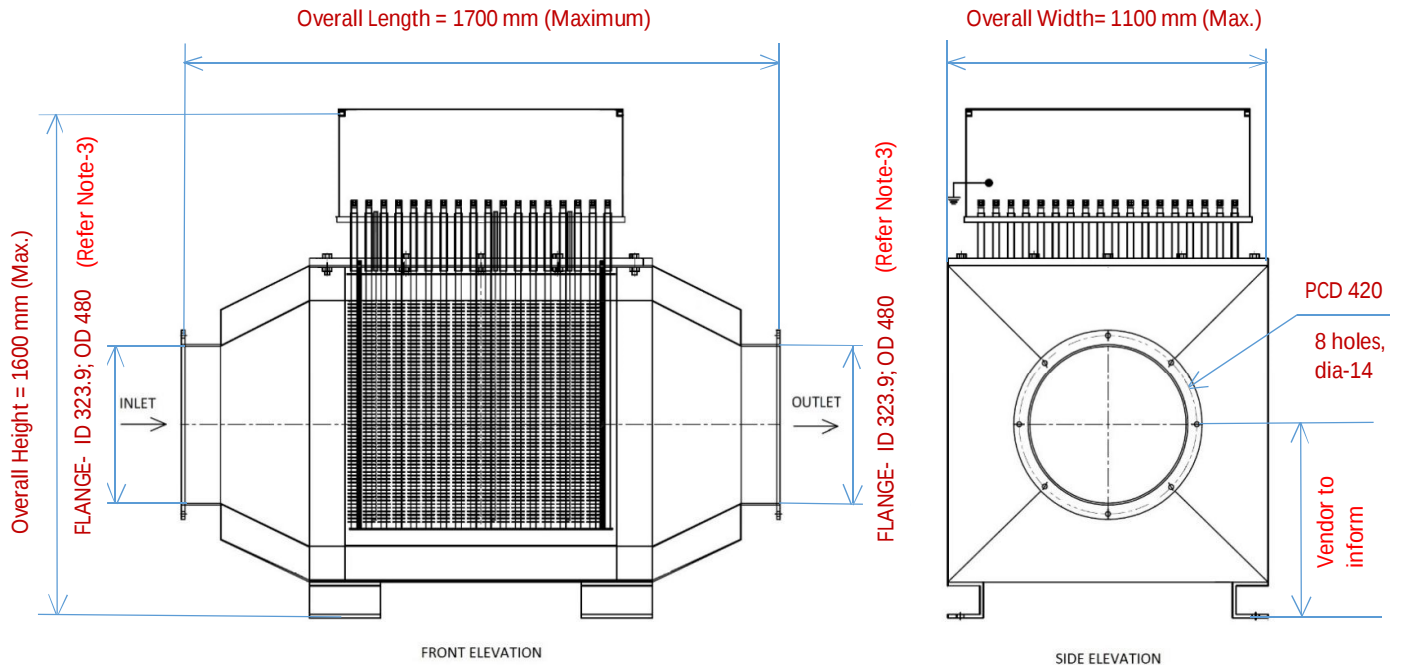
|            |             |                    |                  |                    |
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| <b>SPECIFICATION NO: GDRS: 031</b>                                                | <b>REV NO:00</b>                                                                                 | <b>PROJECT: NTPC Barh stage-1, 3 x 660 MW</b>                                                       |  |

- 5.2. Datasheets showing Instrumentation details
- 5.3. TB Wiring diagram & JB Connection ( Termination) drawing for all Instruments.
- 5.4. Enclosed BHEL Specification pages with Bidder confirmation – signature and seal on all pages.
- 5.5 Current drawn by each Heater Bank & total in full load and Resistance of each heater bank values.

|            |             |                    |                  |                    |
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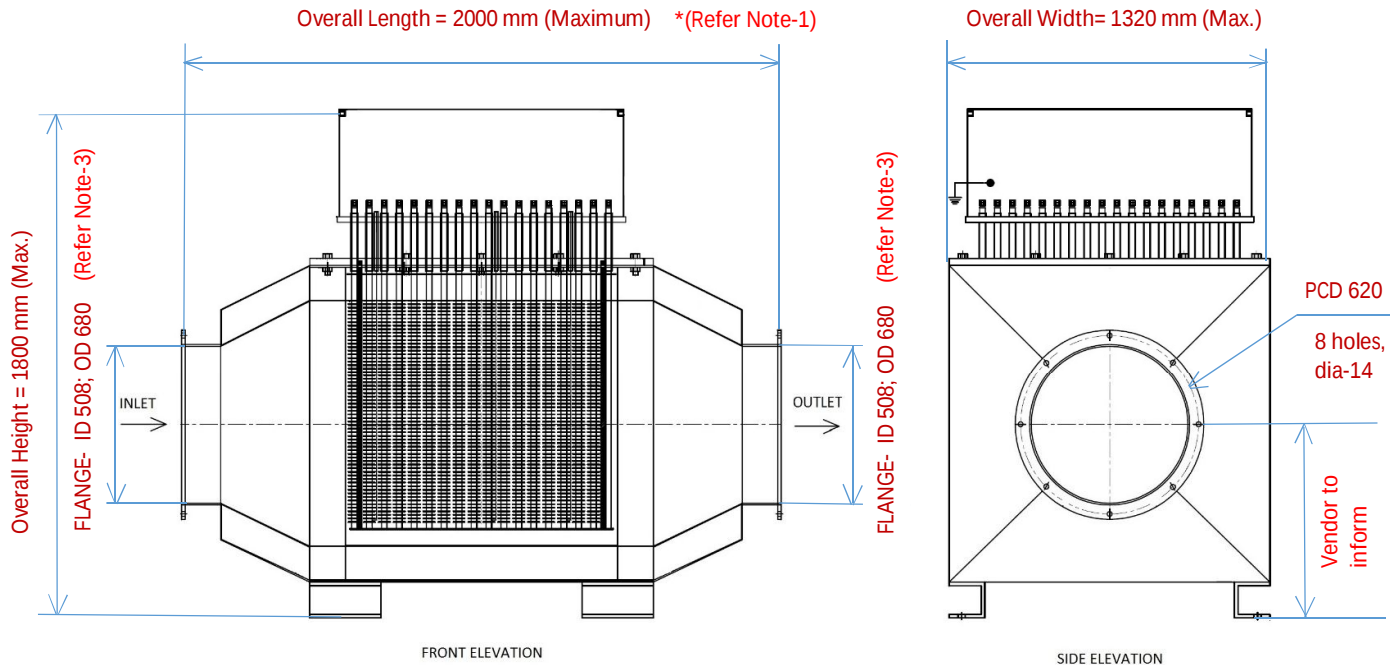
## General Arrangement Drawing for Seal Air Duct Heater (149 KW) for FGD Outlet Gate



### NOTES:

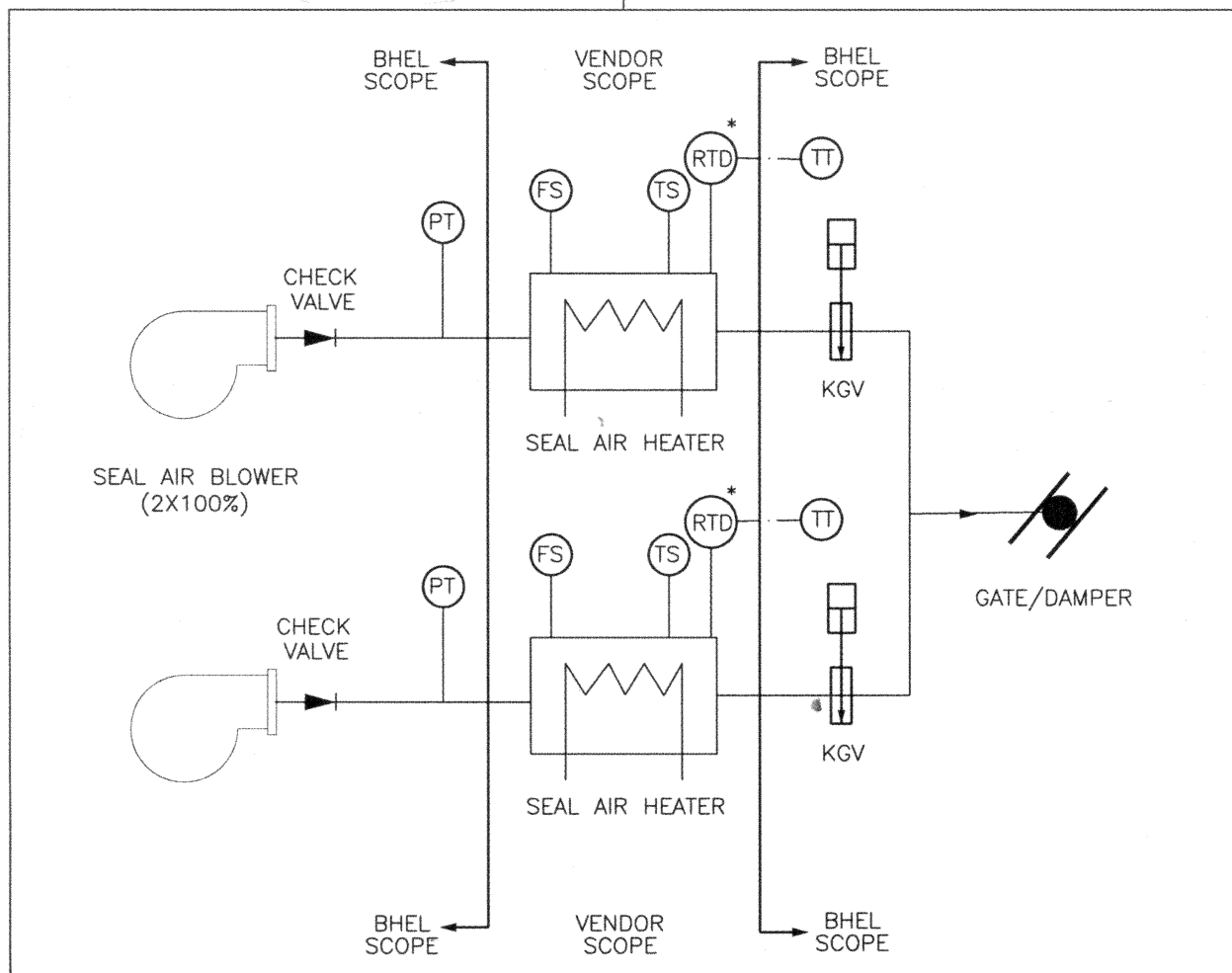
- 1) All dimensions indicated above are in mm.
- 2) The above indicated overall dimensions of Heater are the maximum that can be acceptable by BHEL.
- 3) Pipe sizes used (in BHEL's scope): -  
Upstream: OD 323.9 x 4 mm  
Downstream: OD 323.9 x 4 mm
- 4) Heater flanges (upstream and downstream) are in Heater Vendor's scope of supply. Counter flanges (Mating Flanges) are in BHEL's scope.
- 5) Heater mounting channels & mounting fasteners (at the bottom of heater) are under heater vendor's scope of supply. The mounting details shall be clearly indicated in the GA drawing of Heater submitted by the vendor.
- 6) The GA drawing of Heater showing all mandatory dimensions (including heater flanges and heater mounting details) should be submitted for BHEL Engineering approval within 15 days from the date of placement of Purchase Order.
- 7) Instrumentation Junction Box is in Vendor scope. Submit Wiring diagram showing termination (connections) of different instruments like Flow switch, space heater, Temperature switch, Temperature transmitter.

## General Arrangement Drawing for Seal Air Duct Heater (305 & 525 KW) for FGD Bypass Damper



### NOTES:

- 1) All dimensions indicated above are in mm. For Units-1 &2: 525 KW & for unit 3: 305 KW  
 \* - Overall Length for 305 KW  $\leq$  2000 mm. For 525 KW, Overall Length  $\leq$  2300 mm
- 2) The above indicated overall dimensions of Heater are the maximum that can be acceptable by BHEL.
- 3) Pipe sizes used (in BHEL's scope): -  
 Upstream: OD 508 x 4.8 mm (for units- 1 &2). It is OD457 x 4.5 mm, OD: 604 & PCD: 560 ,8 Holes for Unit-3  
 Downstream: OD 508 x 4.8 mm for all 3 units.
- 4) Heater flanges (upstream and downstream) are in Heater Vendor's scope of supply. Counter flanges (Mating Flanges) are in BHEL's scope.
- 5) Heater mounting channels & mounting fasteners (at the bottom of heater) are under heater vendor's scope of supply. The mounting details shall be clearly indicated in the GA drawing of Heater submitted by the vendor.
- 6) The GA drawing of Heater showing all mandatory dimensions (including heater flanges and heater mounting details) should be submitted for BHEL Engineering approval within 15 days from the date of placement of Purchase Order.
- 7) Instrumentation Junction Box is in Vendor scope. Submit Wiring diagram showing termination (connections) of different instruments like Flow switch, space heater, Temperature switch, Temperature transmitter.



#### NOTES :

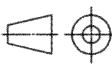
01. TS , RTD & FS SHOULD BE INCLUDED BY VENDOR ALONG WITH THE SEAL AIR HEATER
02. MINIMUM ONE THERMOCOUPLE PER HEATER BANK IS TO BE PROVIDED (IF REQUIRED BY VENDOR'S STANDARD DESIGN)
03. ANY OTHER INSTRUMENTS IF REQUIRED (OTHER THAN THESE) AS PER VENDOR'S DESIGN SHALL BE SUPPLIED AT NO ADDITIONAL COST IN VENDOR SCOPE

#### LEGEND :

PT – PRESSURE TRANSMITTER (BHEL SCOPE)  
 TT – TEMPERATURE TRANSMITTER (BHEL SCOPE)  
 KGV – PNEUMATICALLY OPERATED KNIFE GATE VALVE (BHEL SCOPE)  
 TS – TEMPERATURE SWITCH (VENDOR SCOPE)

\* RTD – MIN. 1 NO. RTD PER HEATER BANK COMPATIBLE FOR PROFIBUS / FOUNDATION  
 FIELDBUS TEMPERATURE TRANSMITTER (RTD– VENDOR SCOPE)

FS – FLOW SWITCH (VENDOR SCOPE)

|                                                                                                                                                                                    |                        |                                                                                     |       |                      |                               |      |                  |                 |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|-------------------------------------------------------------------------------------|-------|----------------------|-------------------------------|------|------------------|-----------------|
|  <b>BHARAT HEAVY ELECTRICALS LTD.,</b><br>UNIT: BOILER AUXILIARIES PLANT,<br>RANIPET – 632 406. |                        |                                                                                     |       | DRN                  | NAME<br>ALOKA                 | SIGN | DATE<br>08.08.19 | NO. OF<br>VAR   |
|                                                                                                                                                                                    |                        |                                                                                     |       | CHD                  | MANU                          |      | 08.08.19         |                 |
|                                                                                                                                                                                    |                        |                                                                                     |       | APPD                 | ASHWIN                        |      | 08.08.19         |                 |
| DEPT                                                                                                                                                                               | GRADE OF<br>UNTOL. DIM |  | SCALE | WEIGHT (KG).         | REF. TO ASSY./OLD DRG.        |      | ITEM NO.         | NO. OF<br>ITEMS |
| CODE                                                                                                                                                                               | PR: QA: 500            |                                                                                     |       |                      |                               |      |                  |                 |
| TITLE<br>SCHEMATIC SHOWING THE SEAL AIR SYSTEM<br>FOR GATE/DAMPER WITH HEATER<br>BARH STAGE-I                                                                                      |                        |                                                                                     |       | CARD<br>CODE<br>U 01 | DRAWING NO.<br>4-57-999-25173 |      |                  | REV<br>00       |

|                                                                                   |                                                                                                  |                                                                                                                                       |
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**TECHNICAL DATA SHEET FOR PT-100 RTD**

| PARTICULARS            | SPECIFICATION REQUIREMENT                                                                                                                                         | VENDOR COMMENTS/<br>CONFIRMATION |
|------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------|
| Make                   |                                                                                                                                                                   |                                  |
| Model No.              |                                                                                                                                                                   |                                  |
| Type                   | Pt-100 RTD, Duplex, Mineral insulated                                                                                                                             |                                  |
| Calibration            | CLASS-A (Accuracy as per DIN-43760)                                                                                                                               |                                  |
| Element Material       |                                                                                                                                                                   |                                  |
| Terminals              | Terminated in to ceramic spring loaded terminal block                                                                                                             |                                  |
| Terminal Material      |                                                                                                                                                                   |                                  |
| Accuracy               | DIN-43760                                                                                                                                                         |                                  |
| <b>Sheath</b>          |                                                                                                                                                                   |                                  |
| OD                     | 6mm                                                                                                                                                               |                                  |
| Material               | SS321                                                                                                                                                             |                                  |
| Overall length         | 250mm                                                                                                                                                             |                                  |
| Nipple-Union-Nipple    | NA                                                                                                                                                                |                                  |
| No. of wire            | 3 wire system, Duplex Mineral insulated.                                                                                                                          |                                  |
| Head cover type        | Screwed type with SS chain                                                                                                                                        |                                  |
| Head Assembly Material | Die Casted Aluminum with IP-65 protection                                                                                                                         |                                  |
| Cable entry            | ½” NPT (F) Weatherproof nickel plated brass double compression cable.                                                                                             |                                  |
| No. of Cable Entries   | 2 Nos of cable entries to be provided out of which 01 No cable entry will be plugged with Ni plated brass plug & other entry with double compression cable gland. |                                  |

Note: Minimum one no. RTD per Heater Bank is to be supplied.

VENDOR SIGN & SEAL

|                                                                                   |                                                                                                  |                                                                                                                                       |
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|                                       |
|---------------------------------------|
| <b>DATA SHEET FOR AIR FLOW SWITCH</b> |
|---------------------------------------|

| PARTICULARS                            | SPECIFICATION REQUIREMENT                                                            | VENDOR COMMENTS/<br>CONFIRMATION |
|----------------------------------------|--------------------------------------------------------------------------------------|----------------------------------|
| Make                                   |                                                                                      |                                  |
| Model No.                              |                                                                                      |                                  |
| Type                                   | Magnetically coupled Vane Actuated type.                                             |                                  |
| Material of construction for:          |                                                                                      |                                  |
| Body, Pin                              | AISI SS321                                                                           |                                  |
| Flapper                                | SS316.                                                                               |                                  |
| Switch cover                           | Cast Al. Weatherproof as per IP 67.                                                  |                                  |
| Process Connection                     | 1 ½" BSPT (M).                                                                       |                                  |
| Signalisation                          | Hermetically Sealed Dry Contact Switch.                                              |                                  |
| Contact form                           | 2 NO + 2 NC (2 SPDT).                                                                |                                  |
| Contact rating                         | 5A, 240V AC or 0.25A at 220V DC.                                                     |                                  |
| Electrical connection                  | 7 Pin Plug & Socket.                                                                 |                                  |
| Accuracy                               | ± 1 % FSR                                                                            |                                  |
| Repeatability                          | ± 0.5 % FSR.                                                                         |                                  |
| Maximum working Pressure & Temperature | 5 kg/cm <sup>2</sup> & 50 <sup>0</sup> C.                                            |                                  |
| Qty                                    | 2 nos per FGD unit (1 No. for FGD Outlet Gate Heater & 1 No. for FGD Bypass Damper). |                                  |

VENDOR SIGN & SEAL



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**INSTRUMENT DATA SHEETS**  
**FOR SEAL AIR DUCT HEATER**  
**Rev.01.dt.20.06.2019**

**TECHNICAL DATA SHEET FOR THERMOCOUPLE**

| <b>PARTICULARS</b>                  | <b>SPECIFICATION REQUIREMENT</b>                                                                                                                                   | <b>VENDOR COMMENTS/<br/>CONFIRMATION</b> |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|
| Make                                |                                                                                                                                                                    |                                          |
| Model No.                           |                                                                                                                                                                    |                                          |
| Type                                | K-Type Thermocouple, Duplex, Mineral insulated, Ungrounded junction.                                                                                               |                                          |
| Calibration                         | As per IEC 584 (Special limit of errors)                                                                                                                           |                                          |
| Element Material                    | Chromel - Alumel                                                                                                                                                   |                                          |
| Terminals                           | Terminated into ceramic spring loaded terminal block                                                                                                               |                                          |
| Terminal Material                   | Silver plated Brass                                                                                                                                                |                                          |
| Accuracy                            | Class-1 as per IEC 584 for TC                                                                                                                                      |                                          |
| <b>Sheath</b>                       |                                                                                                                                                                    |                                          |
| Sensor element connection wire size | 16 AWG (1.2mm)                                                                                                                                                     |                                          |
| OD:(Sensor element tube outer dia)  | 6mm                                                                                                                                                                |                                          |
| Material                            | SS321                                                                                                                                                              |                                          |
| Overall length                      | 1200 mm (Max)                                                                                                                                                      |                                          |
| Nipple-Union-Nipple                 | NA                                                                                                                                                                 |                                          |
| No. of wire                         | 2 wire system, Duplex Mineral insulated.                                                                                                                           |                                          |
| Head Cover type                     | Screwed type with SS chain                                                                                                                                         |                                          |
| Cable entry                         | ½" NPT (F) Weather proof nickel plated brass double compression cable.                                                                                             |                                          |
| No. of Cable Entries                | 2 Nos of cable entries to be provided out of which 01 No. cable entry will be plugged with Ni plated brass plug & other entry with double compression cable gland. |                                          |

Note: Minimum one Thermocouple per Heater Bank is to be provided ( if required by vendor's design / standard)

**VENDOR SIGN & SEAL**

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|  | <b>Bharat Heavy Electricals Ltd</b><br><b>Boiler Auxiliaries Plant</b><br><b>Ranipet-632 406</b> | <b>EDC/GATES &amp; DAMPERS</b><br><br><b>SEAL AIR DUCT HEATER</b><br><b>INSPECTION AND TEST PROCEDURE</b> |                  |  |
| DOCUMENT NO: G&D-Duct-Htr-ITP-001                                                 |                                                                                                  | REV NO:00                                                                                                 | PAGE NO 01 OF 04 |  |

## >> CONTENTS <<

1. Scope of application
2. Applying standards
3. Test and inspection items
4. Test and inspection methods
5. Packing
6. Test report
7. Attachment

|            |             |                    |                  |                    |
|------------|-------------|--------------------|------------------|--------------------|
| 01         | 20.06.2019  | Fresh Release      | MANU ALEX THOMAS | D. ASHWIN DHINAKAR |
| <b>REV</b> | <b>DATE</b> | <b>DESCRIPTION</b> | <b>PREPARED</b>  | <b>APPROVED</b>    |

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| DOCUMENT NO: G&D-Duct-Htr-ITP-001                                                 |                                                                                                  | REV NO:00                                                                                                 | PAGE NO 02 OF 04 |  |

## 1. Scope of application

This procedure applies to Electric Heating coils in accordance with the requirement of the procurement specification related to Gates & Dampers.

## 2. Applying standards

- 2.1. UL 1096: Electric Central Air Heating Equipment (1986 Edition)
- 2.2. IS 4159 : Mineral filled sheathed Heating Elements

## 3. Test and inspection items

- 3.1. Material test
- 3.2. Appearance and Assembly inspection
- 3.3. Performance test
  - 3.3.1. Electric Heating Coil
    - 1) Insulation Resistance Test
    - 2) Dielectric Voltage-Withstand Test
    - 3) Capacity Test

## 4. Test and inspection methods

### 4.1. Material test

Materials testing and inspection is Electric Heating Coil & Heater main components- CASING & TUBE applies.

#### 4.1.1. Inspection procedures

Inspections according to specifications provided by referring to the CODE itself making applying for those of you who are on-the-spot checks, and other important parts of the material directly to the MAKER's review of MILLSHEET instead.

#### 4.1.2. Criterion

Within its scope shall be satisfied.

|     |            |               |                  |                    |
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|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|--|--|
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| DOCUMENT NO: G&D-Duct-Htr-ITP-001                                                 | REV NO:00                                                                                        | PAGE NO 03 OF 04                                                                                          |  |  |

#### 4.2. Assembly inspection

##### 4.2.1. Scope of application

- Assembly inspection is carried out on the HEATER's CASING, fully assembled State.

##### 4.2.2. Test Procedure

- Assembly geometry checks are part of the facade, as well as the quantity, condition, and nameplate.
- Electric Heating Coil dimensions check the assembled Heater in the assembly drawings & dimensions and completeness checks.

##### 4.2.3. Criterion

- Should be satisfied with the value presented in the Specification.

#### 4.3. Performance test

##### 4.3.1. Electric Heating Coil

##### 1) Insulation Resistance Test

###### -1. Applying standards

\* Insulation resistance test applies to Electric Heating Coil assembled.

###### -2. Test methods

\* Heating Element with the charge of the unfilled part 500V between metal and insulation resistance meter measures the value  $2M\Omega$  must be at least.

###### -3. Inspection instruments

\* Insulation Tester

###### -4. Criterion

\* Should be satisfied with the value presented in the Specification.

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|-----|------------|---------------|------------------|--------------------|
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|-----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|--|--|
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| DOCUMENT NO: G&D-Duct-Htr-ITP-001                                                 | REV NO:00                                                                                        | PAGE NO 04 OF 04                                                                                          |  |  |

## 2) Dielectric Voltage-Withstand Test

### -1. Applying standards

\* In accordance with the test criteria presented in the Specification.

### -2. Test methods

\* 1, 000V + 2Vb voltage in the surface of the SHEATH TUBE and Terminal for one minute by floodlights.

### -3. Inspection instruments

\* PUNCTURE TESTER

### -4. Criterion

\* Should be satisfied with the value presented in the Specification.

## 3) Capacity Test

### -1. Applying standards

\* Based on the proposed capacity.

### -2. Test methods

\* Main Terminal, R/S/T by measuring the capacity of the individual on the end-to-end computed. ( $\pm 7\%$ )

### -3. Inspection instruments

\* MULTI-TESTER

### -4. Criterion

\* Should be satisfied with the value presented in the Specification.

## 5. Packing

5.1. After the installation of completely assembled dimensions shall be conducted in accordance with the packaging.

|     |            |               |                  |                    |
|-----|------------|---------------|------------------|--------------------|
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| REV | DATE       | DESCRIPTION   | PREPARED         | APPROVED           |

| <b>DIMENSION INSPECTION RECORD</b><br><b>- SEAL AIR (DUCT) HEATER</b>                                                                                                                                                          |               | BHEL Ref. No:<br><b>G&amp;D-Duct-Htr-Report-Dim</b> |   |                    |   |   |   |        |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------|---|--------------------|---|---|---|--------|
|                                                                                                                                                                                                                                |               | Report No.:                                         |   |                    |   |   |   |        |
|                                                                                                                                                                                                                                |               | Page: 1 of 1                                        |   |                    |   |   |   |        |
| Project Name:                                                                                                                                                                                                                  |               | Equipment No.                                       |   | Purchase Order No. |   |   |   |        |
| Drawing No. / Revision No.                                                                                                                                                                                                     |               | Description                                         |   | Date               |   |   |   |        |
|                                                                                                                                                                                                                                |               |                                                     |   |                    |   |   |   |        |
|                                                                                                                                                                                                                                | Equipment No. | DIMENSION (SPEC. / ACTUAL) Tolerance $\pm 3$ mm     |   |                    |   |   |   | Result |
|                                                                                                                                                                                                                                |               | A                                                   | B | C                  | D | E | F |        |
| 1                                                                                                                                                                                                                              |               |                                                     |   |                    |   |   |   |        |
| 2                                                                                                                                                                                                                              |               |                                                     |   |                    |   |   |   |        |
| 3                                                                                                                                                                                                                              |               |                                                     |   |                    |   |   |   |        |
| 4                                                                                                                                                                                                                              |               |                                                     |   |                    |   |   |   |        |
| 5                                                                                                                                                                                                                              |               |                                                     |   |                    |   |   |   |        |
| 6                                                                                                                                                                                                                              |               |                                                     |   |                    |   |   |   |        |
| Prepared By: _____<br><br><div style="display: flex; justify-content: space-between;"> <div>           Approved By: _____         </div> <div>           Witness By: _____<br/>           (if necessary)         </div> </div> |               |                                                     |   |                    |   |   |   |        |

|                                                                                                                                               |                           |                                                      |                    |
|-----------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|------------------------------------------------------|--------------------|
| <b>ELECTRIC HEATER TEST REPORT</b>                                                                                                            |                           | BHEL Ref. No:<br><b>G&amp;D-Duct-Htr-Report-Elec</b> |                    |
|                                                                                                                                               |                           | Report No.:                                          |                    |
|                                                                                                                                               |                           | Page: 1 of 1                                         |                    |
| Project Name:                                                                                                                                 |                           | Equipment No.                                        | Purchase Order No. |
| Drawing No. / Revision No.                                                                                                                    |                           | Description                                          | Date               |
| <b>MEASURING DATA</b>                                                                                                                         |                           |                                                      |                    |
| TEST ITEM                                                                                                                                     | SPECIFIED VALUE           | MEASURING VALUE                                      | RESULTS            |
| Capacity                                                                                                                                      | KW                        | KW                                                   | ACCEPT             |
| Current                                                                                                                                       | A                         | A                                                    | ACCEPT             |
| Ambient Temperature                                                                                                                           | °C                        | °C                                                   | ACCEPT             |
| Withstand voltage test                                                                                                                        | AC 2V + 1,000V / 1 Minute | V                                                    | ACCEPT             |
| Insulation Resistance                                                                                                                         | DC 1000V / ABOVE 2MΩ      | MΩ ↑                                                 | ACCEPT             |
| <p>* Calculation      <math display="block">\frac{(V / \sqrt{3})^2 \times 2 \times 3}{R (\Omega)} = \text{Watt}</math></p>                    |                           |                                                      |                    |
| <p><u>TEST RESULTS</u></p> <p> <input checked="" type="checkbox"/> Acceptable         <input type="checkbox"/> Unacceptable       </p>        |                           |                                                      |                    |
| <p>Prepared By: _____</p> <p>         Approved By: _____         <span style="float: right;">Witness By: _____<br/>(if necessary)</span> </p> |                           |                                                      |                    |