

## Enquiry No. B/4066/6/3833/V1

**PRE-QUALIFICATION REQUIREMENTS**

Bidders are required to meet the pre-qualification requirements (PQR) for supply of Thermal Insulation of TIP as per criteria stipulated below:

| Sl. No. | Pre-Qualification Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                           | Vendor's confirmation<br>Indicating page no.<br>where documents are<br>placed |
|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------|
| 1.      | Vendor should have an experience in Design, Supply & Application of Thermal Insulation of Hot Pipes (as per ASTM C 680-89 or equivalent) of at least 1 complete SG/TG Sets of 200 MW or above projects, and satisfying the criteria below -<br>A. Min Pipe Size covered = Nb400<br>B. Temperature of Operating Fluid = 350 °C and above                                                                                                                                  |                                                                               |
| 2.      | Vendor should furnish the following documents -<br>a. Purchase Order copy in support of sl no.1 above, along with all Technical Annexures like BOM, Site Data conditions etc. This Purchase Order should not be older than 5 years, as on the date of bid opening.<br>b. An End User Certificate or a Work Completion Certificate from end user/client in support of sl no 2(a) above. This certificate should not be older than 5 years, as on the date of bid opening. |                                                                               |
| 3.      | Those vendors who have already received Purchase Orders from BHEL, Haridwar for Thermal Insulation as per sl no 1 above, need to furnish only the Purchase Order number and date. They need not furnish the cross referred documents pertaining to sl no 2 above.                                                                                                                                                                                                        |                                                                               |
| 4.      | BHEL reserves the right to verify information submitted by vendor. In case the information is found false/ incorrect, the offer shall be rejected.                                                                                                                                                                                                                                                                                                                       |                                                                               |

**Notes:**

1. BHEL would consider the offers and open the price bids of only those bidders, who fulfill the Pre-Qualification requirements (PQRs).

**Bill of Materials for Thermal Insulation of TIP  
Turbine Drainage System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 1     | MAG10BR100         | CAP       | 450                           | 114.3        | -          |       |     |         |        |       |      | 1   |          |                                                     |
| 2     |                    | CAP       | 450                           | 323.9        | -          |       |     |         |        |       |      | 1   |          |                                                     |
| 3     |                    | ELBOW     | 450                           | 1219         | -          | 1     |     |         |        |       |      |     |          |                                                     |
| 4     |                    | TEE       | 450                           | 1219         | -          |       | 5   |         |        |       |      |     |          |                                                     |
| 5     |                    | TUBE/PIPE | 450                           | 114.3        | 1          |       |     |         |        |       |      |     |          |                                                     |
| 6     |                    | TUBE/PIPE | 450                           | 33.4         | 0.5        |       |     |         |        |       |      |     |          |                                                     |
| 7     |                    | TUBE/PIPE | 450                           | 168.3        | 0.5        |       |     |         |        |       |      |     |          |                                                     |
| 8     |                    | TUBE/PIPE | 450                           | 323.9        | 0.5        |       |     |         |        |       |      |     |          |                                                     |
| 9     |                    | TUBE/PIPE | 450                           | 1219         | 10         |       |     |         |        |       |      |     |          |                                                     |
| 10    | MAG10BR101         | ELBOW     | 450                           | 323.9        | -          | 2     |     |         |        |       |      |     |          |                                                     |
| 11    |                    | TUBE/PIPE | 450                           | 323.9        | 2          |       |     |         |        |       |      |     |          |                                                     |
| 12    | MAG10BR102         | ELBOW     | 80                            | 323.9        | -          | 1     |     |         |        |       |      |     |          |                                                     |
| 13    |                    | FLANGE    | 80                            | 323.9        | -          |       |     |         | 2      |       |      |     |          |                                                     |
| 14    |                    | TEE       | 80                            | 323.9        | -          |       | 1   |         |        |       |      |     |          |                                                     |
| 15    |                    | TUBE/PIPE | 80                            | 323.9        | 11         |       |     |         |        |       |      |     |          |                                                     |
| 16    | MAG10BR110         | CAP       | 450                           | 1219         | -          |       |     |         |        |       |      |     |          |                                                     |
| 17    |                    | CAP       | 450                           | 114.3        | -          |       |     |         |        |       |      |     |          |                                                     |
| 18    |                    | ELBOW     | 450                           | 1219         | -          | 1     |     |         |        |       |      |     |          |                                                     |
| 19    |                    | TEE       | 450                           | 1219         | -          |       | 5   |         |        |       |      |     |          |                                                     |
| 20    |                    | TUBE/PIPE | 450                           | 168.3        | 0.5        |       |     |         |        |       |      |     |          |                                                     |
| 21    |                    | TUBE/PIPE | 450                           | 33.4         | 0.5        |       |     |         |        |       |      |     |          |                                                     |
| 22    |                    | TUBE/PIPE | 450                           | 114.3        | 0.5        |       |     |         |        |       |      |     |          |                                                     |
| 23    |                    | TUBE/PIPE | 450                           | 323.9        | 1          |       |     |         |        |       |      |     |          |                                                     |
| 24    |                    | TUBE/PIPE | 450                           | 1219         | 9          |       |     |         |        |       |      |     |          |                                                     |
| 25    | MAG10BR111         | ELBOW     | 450                           | 323.9        | -          | 2     |     |         |        |       |      |     |          |                                                     |
| 26    |                    | TUBE/PIPE | 450                           | 323.9        | 2          |       |     |         |        |       |      |     |          |                                                     |
| 27    | MAG10BR112         | ELBOW     | 80                            | 323.9        | -          | 1     |     |         |        |       |      |     |          |                                                     |
| 28    |                    | TEE       | 80                            | 323.9        | -          |       | 1   |         |        |       |      |     |          |                                                     |
| 29    |                    | TUBE/PIPE | 80                            | 323.9        | 12.5       |       |     |         |        |       |      |     |          |                                                     |
| 30    | MAL01BR001         | ELBOW     | 593                           | 323.8        | -          | 1     |     |         |        |       |      |     |          |                                                     |
| 31    |                    | CAP       | 593                           | 323.8        | -          |       |     |         |        |       |      |     |          |                                                     |
| 32    |                    | TUBE/PIPE | 593                           | 323.8        | 3          |       |     |         |        |       |      |     |          |                                                     |
| 33    |                    | TEE       | 593                           | 323.8        | -          |       | 8   |         |        |       |      |     |          |                                                     |
| 34    |                    | WELDOLET  | 593                           | 33.4         | -          |       |     |         |        |       |      |     | 4        |                                                     |
| 35    |                    | WELDOLET  | 593                           | 73           | -          |       |     |         |        |       |      |     | 4        |                                                     |



**Bill of Materials for Thermal Insulation of TIP  
Turbine Drainage System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 36    | MAL02BR001         | TEE       | 593                           | 323.8        | -          |       | 6   |         |        |       |      |     |          |                                                     |
| 37    |                    | CAP       | 593                           | 323.8        | -          |       |     |         |        |       |      |     |          |                                                     |
| 38    |                    | TUBE/PIPE | 593                           | 323.8        | 3          |       |     |         |        |       |      |     |          |                                                     |
| 39    |                    | WELDOLET  | 593                           | 323.8        | -          |       |     |         |        |       |      |     | 3        |                                                     |
| 40    | MAL03BR001         | ELBOW     | 593                           | 323.8        | -          | 2     |     |         |        |       |      |     |          |                                                     |
| 41    |                    | TUBE/PIPE | 593                           | 323.8        | 4          |       |     |         |        |       |      |     |          |                                                     |
| 42    |                    | WELDOLET  | 593                           | 60.3         | -          |       |     |         |        |       |      |     | 1        |                                                     |
| 43    |                    | WELDOLET  | 593                           | 73           | -          |       |     |         |        |       |      |     | 5        |                                                     |
| 44    |                    | WELDOLET  | 593                           | 114.3        | -          |       |     |         |        |       |      |     | 1        |                                                     |
| 45    |                    | WELDOLET  | 593                           | 48.3         | -          |       |     |         |        |       |      |     | 1        |                                                     |
| 46    |                    | CAP       | 593                           | 323.8        | -          |       |     |         |        |       |      |     |          |                                                     |
| 47    | MAL04BR001         | ELBOW     | 593                           | 323.8        | -          | 2     |     |         |        |       |      |     |          |                                                     |
| 48    |                    | CAP       | 593                           | 323.8        | -          |       |     |         |        |       |      | 1   |          |                                                     |
| 49    |                    | TUBE/PIPE | 593                           | 323.8        | 4          |       |     |         |        |       |      |     |          |                                                     |
| 50    |                    | WELDOLET  | 593                           | 60.3         | -          |       |     |         |        |       |      |     | 1        |                                                     |
| 51    |                    | WELDOLET  | 593                           | 73           | -          |       |     |         |        |       |      |     | 5        |                                                     |
| 52    | MAL11BR001         | TEE       | 593                           | 323.8        | -          |       | 12  |         |        |       |      |     |          |                                                     |
| 53    |                    | TEE       | 573                           | 60.3         | -          |       | 1   |         |        |       |      |     |          |                                                     |
| 54    |                    | CAP       | 573                           | 60.3         | -          |       |     |         |        |       |      | 1   |          |                                                     |
| 55    |                    | TEE       | 573                           | 60.3         | -          |       | 1   |         |        |       |      |     |          |                                                     |
| 56    |                    | BEND      | 573                           | 60.3         | -          |       |     |         |        |       | 13   |     |          |                                                     |
| 57    |                    | VALVE     | 573                           | 60.3         | -          |       |     |         |        | 2     |      |     |          |                                                     |
| 58    |                    | TUBE/PIPE | 573                           | 60.3         | 19         |       |     |         |        |       |      |     |          |                                                     |
| 59    | MAL12BR001         | VALVE     | 573                           | 33.4         | -          |       |     |         |        | 1     |      |     |          |                                                     |
| 60    |                    | TEE       | 573                           | 60.3         | -          |       | 1   |         |        |       |      |     |          |                                                     |
| 61    |                    | CAP       | 573                           | 60.3         | -          |       |     |         |        |       |      | 1   |          |                                                     |
| 62    |                    | BEND      | 573                           | 33.4         | -          |       |     |         |        |       | 3    |     |          |                                                     |
| 63    |                    | BEND      | 573                           | 60.3         | -          |       |     |         |        |       | 7    |     |          |                                                     |
| 64    |                    | TUBE/PIPE | 573                           | 60.3         | 24         |       |     |         |        |       |      |     |          |                                                     |
| 65    |                    | VALVE     | 573                           | 33.4         | -          |       |     |         |        | 2     |      |     |          |                                                     |
| 66    | MAL14BR001         | VALVE     | 500                           | 33.4         | -          |       |     |         |        | 2     |      |     |          |                                                     |
| 67    |                    | TEE       | 500                           | 48.3         | -          |       | 1   |         |        |       |      |     |          |                                                     |
| 68    |                    | CAP       | 500                           | 48.3         | -          |       |     |         |        |       |      | 1   |          |                                                     |
| 69    |                    | BEND      | 500                           | 48.3         | -          |       |     |         |        |       | 7    |     |          |                                                     |
| 70    |                    | TUBE/PIPE | 500                           | 48.3         | 17         |       |     |         |        |       |      |     |          |                                                     |





**Bill of Materials for Thermal Insulation of TIP  
Turbine Drainage System**

| Sl No | TAG No of the Line                     | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|----------------------------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 71    | MAL19BR001                             | CAP       | 573                           | 60.3         | -          |       |     |         |        |       |      | 1   |          |                                                     |
| 72    |                                        | TEE       | 573                           | 60.3         | -          |       | 1   |         |        |       |      |     |          |                                                     |
| 73    |                                        | VALVE     | 573                           | 60.3         | -          |       |     |         |        | 2     |      |     |          |                                                     |
| 74    |                                        | BEND      | 573                           | 60.3         | -          |       |     |         |        |       | 12   |     |          |                                                     |
| 75    |                                        | TUBE/PIPE | 573                           | 60.3         | 17         |       |     |         |        |       |      |     |          |                                                     |
| 76    | MAL20BR001                             | CAP       | 517                           | 60.3         | -          |       |     |         |        |       |      | 1   |          |                                                     |
| 77    |                                        | TEE       | 517                           | 60.3         | -          |       | 1   |         |        |       |      |     |          |                                                     |
| 78    |                                        | BEND      | 517                           | 60.3         | -          |       |     |         |        |       | 6    |     |          |                                                     |
| 79    |                                        | TUBE/PIPE | 517                           | 60.3         | 16         |       |     |         |        |       |      |     |          |                                                     |
| 80    |                                        | VALVE     | 517                           | 60.3         | -          |       |     |         |        | 2     |      |     |          |                                                     |
| 81    | MAL22BR001<br>MAL22BR002<br>MAL22BR003 | VALVE     | 520                           | 60.3         | -          |       |     |         |        | 2     |      |     |          |                                                     |
| 82    |                                        | BEND      | 520                           | 60.3         | -          |       |     |         |        |       | 8    |     |          |                                                     |
| 83    |                                        | CAP       | 520                           | 60.3         | -          |       |     |         |        |       |      | 1   |          |                                                     |
| 84    |                                        | REDUCER   | 520                           | 60.3         | -          |       |     | 1       |        |       |      |     |          |                                                     |
| 85    |                                        | TEE       | 520                           | 60.3         | -          |       | 2   |         |        |       |      |     |          |                                                     |
| 86    |                                        | ELBOW     | 520                           | 48.3         | -          | 1     |     |         |        |       |      |     |          |                                                     |
| 87    |                                        | BEND      | 520                           | 48.3         | -          |       |     |         |        |       | 13   |     |          |                                                     |
| 88    |                                        | TUBE/PIPE | 520                           | 48.3         | 7          |       |     |         |        |       |      |     |          |                                                     |
| 89    |                                        | TUBE/PIPE | 520                           | 60.3         | 14         |       |     |         |        |       |      |     |          |                                                     |
| 90    | MAL23BR001<br>MAL23BR002               | BEND      | 593                           | 60.3         | -          |       |     |         |        |       | 12   |     |          |                                                     |
| 91    |                                        | BEND      | 593                           | 60.3         | -          |       |     |         |        |       | 3    |     |          |                                                     |
| 92    |                                        | CAP       | 593                           | 60.3         | -          |       |     |         |        |       |      | 1   |          |                                                     |
| 93    |                                        | TEE       | 593                           | 60.3         | -          |       | 2   |         |        |       |      |     |          |                                                     |
| 94    |                                        | VALVE     | 593                           | 60.3         | -          |       |     |         |        | 2     |      |     |          |                                                     |
| 95    |                                        | TUBE/PIPE | 593                           | 33.4         | 2          |       |     |         |        |       |      |     |          |                                                     |
| 96    |                                        | TUBE/PIPE | 593                           | 60.3         | 19         |       |     |         |        |       |      |     |          |                                                     |
| 97    |                                        | VALVE     | 593                           | 33.4         | -          |       |     |         |        | 3     |      |     |          |                                                     |
| 98    | MAL24BR001                             | BEND      | 593                           | 33.4         | -          |       |     |         |        |       | 3    |     |          |                                                     |
| 99    |                                        | BEND      | 593                           | 60.3         | -          |       |     |         |        |       | 9    |     |          |                                                     |
| 100   |                                        | CAP       | 593                           | 60.3         | -          |       |     |         |        |       |      | 1   |          |                                                     |
| 101   |                                        | TEE       | 593                           | 60.3         | -          |       | 2   |         |        |       |      |     |          |                                                     |
| 102   |                                        | TUBE/PIPE | 593                           | 33.4         | 1.5        |       |     |         |        |       |      |     |          |                                                     |
| 103   |                                        | VALVE     | 593                           | 60.3         | -          |       |     |         |        | 2     |      |     |          |                                                     |
| 104   |                                        | ELBOW     | 593                           | 60.3         | -          | 1     |     |         |        |       |      |     |          |                                                     |
| 105   |                                        | TUBE/PIPE | 593                           | 60.3         | 22         |       |     |         |        |       |      |     |          |                                                     |
| 106   |                                        | VALVE     | 593                           | 33.4         | -          |       |     |         |        | 3     |      |     |          |                                                     |
|       |                                        |           |                               |              |            |       |     |         |        |       |      |     |          |                                                     |



**Bill of Materials for Thermal Insulation of TIP  
Turbine Drainage System**

BHEL DOC NO: 412114V3001 REV\_00  
Dated : 05.12.2016

| Sl No | TAG No of the Line                     | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|----------------------------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 107   | MAL25BR001                             | BEND      | 420                           | 48.3         | -          |       |     |         |        |       | 11   |     |          |                                                     |
| 108   |                                        | VALVE     | 420                           | 48.3         | -          |       |     |         |        | 2     |      |     |          |                                                     |
| 109   |                                        | CAP       | 420                           | 48.3         | -          |       |     |         |        |       |      | 1   |          |                                                     |
| 110   |                                        | TEE       | 420                           | 48.3         | -          |       | 1   |         |        |       |      |     |          |                                                     |
| 111   |                                        | TUBE/PIPE | 420                           | 48.3         | 16         |       |     |         |        |       |      |     |          |                                                     |
| 112   | MAL26BR001                             | BEND      | 593                           | 60.3         |            |       |     |         |        |       | 12   |     |          |                                                     |
| 113   |                                        | CAP       | 593                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 114   |                                        | TEE       | 593                           | 60.3         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 115   |                                        | TUBE/PIPE | 593                           | 60.3         | 13         |       |     |         |        |       |      |     |          |                                                     |
| 116   |                                        | VALVE     | 593                           | 60.3         |            |       |     |         |        | 2     |      |     |          |                                                     |
| 117   | MAL27BR001                             | BEND      | 593                           | 60.3         |            |       |     |         |        |       | 3    |     |          |                                                     |
| 118   |                                        | CAP       | 593                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 119   |                                        | TEE       | 593                           | 60.3         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 120   |                                        | TUBE/PIPE | 593                           | 60.3         | 18         |       |     |         |        |       |      |     |          |                                                     |
| 121   |                                        | VALVE     | 593                           | 60.3         |            |       |     |         |        | 2     |      |     |          |                                                     |
| 122   | MAL31BR001<br>MAL31BR002<br>MAL31BR003 | BEND      | 593                           | 33.4         |            |       |     |         |        |       | 14   |     |          |                                                     |
| 123   |                                        | BEND      | 593                           | 60.3         |            |       |     |         |        |       | 8    |     |          |                                                     |
| 124   |                                        | CAP       | 593                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 125   |                                        | REDUCER   | 593                           | 60.3         |            |       |     | 1       |        |       |      |     |          |                                                     |
| 126   |                                        | TEE       | 593                           | 33.4         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 127   |                                        | TEE       | 593                           | 60.3         |            |       | 2   |         |        |       |      |     |          |                                                     |
| 128   |                                        | VALVE     | 593                           | 60.3         |            |       |     |         |        | 2     |      |     |          |                                                     |
| 129   |                                        | TUBE/PIPE | 593                           | 33.4         | 13         |       |     |         |        |       |      |     |          |                                                     |
| 130   |                                        | TUBE/PIPE | 593                           | 60.3         | 15         |       |     |         |        |       |      |     |          |                                                     |
| 131   | MAL41BR001<br>MAL41BR002               | BEND      | 420                           | 48.3         |            |       |     |         |        |       | 3    |     |          |                                                     |
| 132   |                                        | BEND      | 420                           | 60.3         |            |       |     |         |        |       | 5    |     |          |                                                     |
| 133   |                                        | CAP       | 420                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 134   |                                        | ELBO      | 420                           | 60.3         |            | 1     |     |         |        |       |      |     |          |                                                     |
| 135   |                                        | TEE       | 420                           | 60.3         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 136   |                                        | VALVE     | 420                           | 60.3         |            |       |     |         |        | 2     |      |     |          |                                                     |
| 137   |                                        | TUBE/PIPE | 420                           | 48.3         | 1.5        |       |     |         |        |       |      |     |          |                                                     |
| 138   |                                        | TUBE/PIPE | 420                           | 60.3         | 9          |       |     |         |        |       |      |     |          |                                                     |
| 139   | MAL45BR001                             | CAP       | 490                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 140   |                                        | TEE       | 490                           | 60.3         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 141   |                                        | BEND      | 490                           | 60.3         |            |       | 1   |         |        |       | 7    |     |          |                                                     |
| 142   |                                        | VALVE     | 490                           | 60.3         |            |       |     |         |        | 2     |      |     |          |                                                     |
| 143   |                                        | TUBE/PIPE | 490                           | 60.3         | 11.5       |       |     |         |        |       |      |     |          |                                                     |





**Bill of Materials for Thermal Insulation of TIP**  
**Turbine Drainage System**

| Sl No | TAG No of the Line                     | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|----------------------------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 144   | MAL47BR001                             | CAP       | 431                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 145   |                                        | VALVE     | 431                           | 60.3         |            |       |     |         |        | 2     |      |     |          |                                                     |
| 146   |                                        | BEND      | 431                           | 60.3         |            |       |     |         |        |       | 9    |     |          |                                                     |
| 147   |                                        | TEE       | 431                           | 60.3         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 148   |                                        | TUBE/PIPE | 431                           | 60.3         | 14         |       |     |         |        |       |      |     |          |                                                     |
| 149   | MAL51BR001<br>MAL51BR002<br>MAL51BR003 | BEND      | 291                           | 60.3         |            |       |     |         |        |       | 8    |     |          |                                                     |
| 150   |                                        | BEND      | 291                           | 33.4         |            |       |     |         |        |       | 16   |     |          |                                                     |
| 151   |                                        | CAP       | 291                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 152   |                                        | VALVE     | 291                           | 60.3         |            |       |     |         |        | 2     |      |     |          |                                                     |
| 153   |                                        | TEE       | 291                           | 33.4         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 154   |                                        | ELBOW     | 291                           | 60.3         |            | 1     |     |         |        |       |      |     |          |                                                     |
| 155   |                                        | TEE       | 291                           | 60.3         |            |       | 2   |         |        |       |      |     |          |                                                     |
| 156   |                                        | TUBE/PIPE | 291                           | 33.4         | 6.5        |       |     |         |        |       |      |     |          |                                                     |
| 157   |                                        | TUBE/PIPE | 291                           | 60.3         | 10         |       |     |         |        |       |      |     |          |                                                     |
| 158   | MAL54BR001                             | BEND      | 230                           | 60.3         |            |       |     |         |        |       | 11   |     |          |                                                     |
| 159   |                                        | CAP       | 230                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 160   |                                        | TEE       | 230                           | 60.3         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 161   |                                        | VALVE     | 230                           | 60.3         |            |       |     |         |        | 2     |      |     |          |                                                     |
| 162   |                                        | TUBE/PIPE | 230                           | 60.3         | 23         |       |     |         |        |       |      |     |          |                                                     |
| 163   | MAL55BR001                             | BEND      | 230                           | 60.3         |            |       |     |         |        |       | 7    |     |          |                                                     |
| 164   |                                        | CAP       | 230                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 165   |                                        | TEE       | 230                           | 60.3         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 166   |                                        | VALVE     | 230                           | 60.3         |            |       |     |         |        | 2     |      |     |          |                                                     |
| 167   |                                        | TUBE/PIPE | 230                           | 60.3         | 11         |       |     |         |        |       |      |     |          |                                                     |
| 168   | MAL65BR001                             | BEND      | 393                           | 60.3         |            |       |     |         |        |       | 10   |     |          |                                                     |
| 169   |                                        | CAP       | 393                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 170   |                                        | TEE       | 393                           | 60.3         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 171   |                                        | TUBE/PIPE | 393                           | 60.3         | 14         |       |     |         |        |       |      |     |          |                                                     |
| 172   |                                        | VALVE     | 393                           | 60.3         |            |       |     |         |        | 2     |      |     |          |                                                     |
| 173   | MAL81BR001<br>MAL81BR002<br>MAL81BR004 | BEND      | 520                           | 33.4         |            |       |     |         |        |       | 15   |     |          |                                                     |
| 174   |                                        | CAP       | 520                           | 33.4         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 175   |                                        | ELBOW     | 520                           | 33.4         |            | 1     |     |         |        |       |      |     |          |                                                     |
| 176   |                                        | VALVE     | 520                           | 33.4         |            |       |     |         |        | 2     |      |     |          |                                                     |
| 177   |                                        | TEE       | 520                           | 33.4         |            |       | 3   |         |        |       |      |     |          |                                                     |
| 178   |                                        | TUBE/PIPE | 520                           | 33.4         | 23.5       |       |     |         |        |       |      |     |          |                                                     |



**Bill of Materials for Thermal Insulation of TIP  
Turbine Drainage System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 179   | MAL91BR001         | BEND      | 593                           | 33.4         |            |       |     |         |        |       | 10   |     |          |                                                     |
| 180   |                    | INST      | 593                           | 33.4         |            |       |     |         |        |       |      |     |          |                                                     |
| 181   |                    | REDUCER   | 593                           | 60.3         |            |       |     | 1       |        |       |      |     |          |                                                     |
| 182   |                    | TEE       | 593                           | 33.4         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 183   |                    | TUBE/PIPE | 593                           | 33.4         | 19         |       |     |         |        |       |      |     |          |                                                     |
| 184   | MAL92BR001         | BEND      | 593                           | 33.4         |            |       |     |         |        |       | 6    |     |          |                                                     |
| 185   |                    | INST      | 593                           | 33.4         |            |       |     |         |        |       |      |     |          |                                                     |
| 186   |                    | REDUCER   | 593                           | 60.3         |            |       |     | 1       |        |       |      |     |          |                                                     |
| 187   |                    | TUBE/PIPE | 593                           | 33.4         | 11         |       |     |         |        |       |      |     |          |                                                     |





**Bill of Materials for Thermal Insulation of TIP**  
**Seal Steam System**

| SI No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 1     | LBC41BR001         | BEND      | 379                           | 114.3        |            |       |     |         |        |       | 9    |     |          |                                                     |
| 2     |                    | REDUCER   | 379                           | 168.3/114.3  |            |       |     | 1       |        |       |      |     |          |                                                     |
| 3     |                    | TUBE/PIPE | 379                           | 114.3        | 11         |       |     |         |        |       |      |     |          |                                                     |
| 4     | LBC41BR002         | BEND      | 379                           | 273          |            |       |     |         |        |       | 2    |     |          |                                                     |
| 5     |                    | TUBE/PIPE | 379                           | 273          | 3          |       |     |         |        |       |      |     |          |                                                     |
| 6     |                    | ELBO      | 379                           | 273          |            | 2     |     |         |        |       |      |     |          |                                                     |
| 7     |                    | VALVE     | 379                           | 273          |            |       |     |         |        | 1     |      |     |          |                                                     |
| 8     | MAM10BR001         | BEND      | 459                           | 48.3         |            |       |     |         |        |       | 1    |     |          |                                                     |
| 9     |                    | ELBO      | 459                           | 48.3         |            | 6     |     |         |        |       |      |     |          |                                                     |
| 10    |                    | TUBE/PIPE | 459                           | 48.3         | 7          |       |     |         |        |       |      |     |          |                                                     |
| 11    | MAM10BR002         | BEND      | 459                           | 48.3         |            |       |     |         |        |       | 9    |     |          |                                                     |
| 12    |                    | ELBO      | 459                           | 48.3         |            | 1     |     |         |        |       |      |     |          |                                                     |
| 13    |                    | TUBE/PIPE | 459                           | 48.3         | 18         |       |     |         |        |       |      |     |          |                                                     |
| 14    | MAM10BR003         | BEND      | 459                           | 48.3         |            |       |     |         |        |       | 12   |     |          |                                                     |
| 15    |                    | ELBO      | 459                           | 48.3         |            | 2     |     |         |        |       |      |     |          |                                                     |
| 16    |                    | REDUCER   | 459                           | 73           |            |       |     | 1       |        |       |      |     |          |                                                     |
| 17    |                    | TUBE/PIPE | 459                           | 48.3         | 20         |       |     |         |        |       |      |     |          |                                                     |
| 18    | MAM10BR004         | BEND      | 459                           | 48.3         |            |       |     |         |        |       | 1    |     |          |                                                     |
| 19    |                    | TUBE/PIPE | 459                           | 48.3         | 6          |       |     |         |        |       |      |     |          |                                                     |
| 20    | MAM10BR005         | BEND      | 459                           | 26.7         |            |       |     |         |        |       | 8    |     |          |                                                     |
| 21    |                    | TUBE/PIPE | 459                           | 26.7         | 17         |       |     |         |        |       |      |     |          |                                                     |
| 22    | MAM10BR008         | ELBO      | 459                           | 60.3         |            |       |     |         |        |       | 6    |     |          |                                                     |
| 23    |                    | CAP       | 459                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 24    |                    | TEE       | 459                           | 60.3         |            |       | 2   |         |        |       |      |     |          |                                                     |
| 25    |                    | TUBE/PIPE | 459                           | 60.3         | 16         |       |     |         |        |       |      |     |          |                                                     |
| 26    | MAM10BR010         | BEND      | 459                           | 60.3         |            |       |     |         |        |       | 5    |     |          |                                                     |
| 27    |                    | CAP       | 459                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 28    |                    | TEE       | 459                           | 60.3         |            |       | 2   |         |        |       |      |     |          |                                                     |
| 29    |                    | TUBE/PIPE | 459                           | 60.3         | 18         |       |     |         |        |       |      |     |          |                                                     |
| 30    | MAM20BR001         | BEND      | 293                           | 33.4         |            |       |     |         |        |       | 4    |     |          |                                                     |
| 31    |                    | TUBE/PIPE | 293                           | 33.4         | 3          |       |     |         |        |       |      |     |          |                                                     |
| 32    | MAM20BR002         | BEND      | 293                           | 33.4         |            |       |     |         |        |       | 6    |     |          |                                                     |
| 33    |                    | TUBE/PIPE | 293                           | 33.4         | 4          |       |     |         |        |       |      |     |          |                                                     |
| 34    | MAM20BR003         | BEND      | 411                           | 48.3         |            |       |     |         |        |       | 5    |     |          |                                                     |
| 35    |                    | TUBE/PIPE | 411                           | 48.3         | 11         |       |     |         |        |       |      |     |          |                                                     |





**Bill of Materials for Thermal Insulation of TIP  
Seal Steam System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 36    | MAM20BR005         | CAP       | 411                           | 88.9         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 37    |                    | ELBOW     | 411                           | 88.9         |            | 5     |     |         |        |       |      |     |          |                                                     |
| 38    |                    | WELDOLET  | 411                           | 88.9         |            |       |     |         |        |       |      |     | 1        |                                                     |
| 39    |                    | TEE       | 411                           | 88.9         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 40    |                    | TUBE/PIPE | 411                           | 88.9         | 9          |       |     |         |        |       |      |     |          |                                                     |
| 41    | MAM20BR006         | BEND      | 459                           | 48.3         |            |       |     |         |        |       | 5    |     |          |                                                     |
| 42    |                    | TUBE/PIPE | 459                           | 48.3         | 5          |       |     |         |        |       |      |     |          |                                                     |
| 43    | MAM20BR007         | BEND      | 459                           | 48.3         |            |       |     |         |        |       | 6    |     |          |                                                     |
| 44    |                    | TUBE/PIPE | 459                           | 48.3         | 5          |       |     |         |        |       |      |     |          |                                                     |
| 45    | MAM20BR008         | CAP       | 459                           | 114.3        |            |       |     |         |        |       |      | 1   |          |                                                     |
| 46    |                    | ELBOW     | 459                           | 114.3        |            | 2     |     |         |        |       |      |     |          |                                                     |
| 47    |                    | TEE       | 459                           | 114.3        |            |       | 4   |         |        |       |      |     |          |                                                     |
| 48    |                    | TUBE/PIPE | 459                           | 114.3        | 11         |       |     |         |        |       |      |     |          |                                                     |
| 49    | MAM20BR009         | BEND      | 459                           | 48.3         |            |       |     |         |        |       | 4    |     |          |                                                     |
| 50    |                    | TUBE/PIPE | 459                           | 48.3         | 6          |       |     |         |        |       |      |     |          |                                                     |
| 51    | MAM20BR010         | BEND      | 459                           | 48.3         |            |       |     |         |        |       | 6    |     |          |                                                     |
| 52    |                    | TUBE/PIPE | 459                           | 48.3         | 6          |       |     |         |        |       |      |     |          |                                                     |
| 53    | MAM30BR001         | BEND      | 574                           | 42.2         |            |       |     |         |        |       | 7    |     |          |                                                     |
| 54    |                    | TUBE/PIPE | 574                           | 42.2         | 5          |       |     |         |        |       |      |     |          |                                                     |
| 55    | MAM30BR002         | BEND      | 574                           | 42.2         |            |       |     |         |        |       | 16   |     |          |                                                     |
| 56    |                    | TUBE/PIPE | 574                           | 42.2         | 28         |       |     |         |        |       |      |     |          |                                                     |
| 57    | MAM30BR003         | BEND      | 574                           | 42.2         |            |       |     |         |        |       | 18   |     |          |                                                     |
| 58    |                    | TUBE/PIPE | 574                           | 42.2         | 28         |       |     |         |        |       |      |     |          |                                                     |
| 59    | MAM30BR004         | BEND      | 574                           | 42.2         |            |       |     |         |        |       | 7    |     |          |                                                     |
| 60    |                    | TUBE/PIPE | 574                           | 42.2         | 5          | 6     |     |         |        |       |      |     |          |                                                     |
| 61    | MAM30BR008         | CAP       | 574                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 62    |                    | BEND      | 574                           | 60.3         |            | 9     |     |         |        |       |      |     |          |                                                     |
| 63    |                    | TEE       | 574                           | 60.3         |            |       | 2   |         |        |       |      |     |          |                                                     |
| 64    |                    | TUBE/PIPE | 574                           | 60.3         | 18         |       |     |         |        |       |      |     |          |                                                     |
| 65    | MAM30BR010         | CAP       | 574                           | 60.3         |            |       |     |         |        |       |      | 1   |          |                                                     |
| 66    |                    | BEND      | 574                           | 60.3         |            | 5     |     |         |        |       |      |     |          |                                                     |
| 67    |                    | TEE       | 574                           | 60.3         |            |       | 2   |         |        |       |      |     |          |                                                     |
| 68    |                    | TUBE/PIPE | 574                           | 60.3         | 20         |       |     |         |        |       |      |     |          |                                                     |



**Bill of Materials for Thermal Insulation of TIP**  
**Seal Steam System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 69    | MAW10BR001         | BEND      | 320                           | 273          |            |       |     |         |        |       | 3    |     |          |                                                     |
| 70    |                    | TEE       | 320                           | 273          |            |       | 1   |         |        |       |      |     |          |                                                     |
| 71    |                    | OLET      | 320                           | 273          |            |       |     |         |        |       |      |     | 1        |                                                     |
| 72    |                    | TUBE/PIPE | 320                           | 273          | 2          |       |     |         |        |       |      |     |          |                                                     |
| 73    |                    | VALVE     | 320                           | 273          |            |       |     |         |        | 1     |      |     |          |                                                     |
| 74    | MAW10BR002         | FLANGE    | 320                           | 168.3        |            |       |     |         |        | 2     |      |     |          |                                                     |
| 75    |                    | TEE       | 320                           | 168.3        |            |       | 1   |         |        |       |      |     |          |                                                     |
| 76    |                    | TUBE/PIPE | 320                           | 168.3        | 0.5        |       |     |         |        |       |      |     |          |                                                     |
| 77    |                    | BEND      | 335                           | 88.9         |            |       |     |         |        |       | 1    |     |          |                                                     |
| 78    | MAW10BR101         | TEE       | 335                           | 88.9         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 79    |                    | TUBE/PIPE | 335                           | 88.9         | 1.5        |       |     |         |        |       |      |     |          |                                                     |
| 80    |                    | VALVE     | 335                           | 88.9         |            |       |     |         |        | 1     |      |     |          |                                                     |
| 81    |                    | VALVE     | 335                           | 273          |            |       |     |         |        | 1     |      |     |          |                                                     |
| 82    |                    | BEND      | 335                           | 88.9         |            |       |     |         |        |       | 4    |     |          |                                                     |
| 83    | MAW10BR103         | REDUCER   | 335                           | 168.3        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 84    |                    | REDUCER   | 335                           | 273          |            |       |     | 1       |        |       |      |     |          |                                                     |
| 85    |                    | TUBE/PIPE | 335                           | 88.9         | 2          |       |     |         |        |       |      |     |          |                                                     |
| 86    |                    | VALVE     | 335                           | 88.9         |            |       |     |         |        | 1     |      |     |          |                                                     |
| 87    | MAW10BR104         | BEND      | 320                           | 273          |            |       |     |         |        |       | 2    |     |          |                                                     |
| 88    |                    | TUBE/PIPE | 320                           | 273          | 2          |       |     |         |        |       |      |     |          |                                                     |
| 89    | MAW20BR001         | REDUCER   | 470                           | 323.8        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 90    |                    | BEND      | 470                           | 273          |            |       |     |         |        |       | 2    |     |          |                                                     |
| 91    |                    | FLANGE    | 470                           | 273          |            |       |     |         | 2      |       |      |     |          |                                                     |
| 92    |                    | TEE       | 470                           | 273          |            |       | 2   |         |        |       |      |     |          |                                                     |
| 93    |                    | TUBE/PIPE | 470                           | 273          | 4          |       |     |         |        |       |      |     |          |                                                     |
| 94    | MAW20BR002         | ELBOW     | 470                           | 323.9        |            | 2     |     |         |        |       |      |     |          |                                                     |
| 95    |                    | REDUCER   | 470                           | 323.9        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 96    |                    | TEE       | 470                           | 323.9        |            |       | 3   |         |        |       |      |     |          |                                                     |
| 97    |                    | TUBE/PIPE | 470                           | 323.9        | 4.5        |       |     |         |        |       |      |     |          |                                                     |
| 98    | MAW20BR003         | ELBOW     | 340                           | 273          |            | 2     |     |         |        |       |      |     |          |                                                     |
| 99    |                    | REDUCER   | 340                           | 273          |            |       |     | 1       |        |       |      |     |          |                                                     |
| 100   |                    | TEE       | 340                           | 273          |            |       | 3   |         |        |       |      |     |          |                                                     |
| 101   |                    | TUBE/PIPE | 340                           | 273          | 9          |       |     |         |        |       |      |     |          |                                                     |





**Bill of Materials for Thermal Insulation of TIP  
Seal Steam System**

| SI No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 102   | MAW20BR004         | FLANGE    | 340                           | 219.1        |            |       |     |         | 2      |       |      |     |          |                                                     |
| 103   |                    | OLET      | 340                           | 219.1        |            |       |     |         |        |       |      |     | 3        |                                                     |
| 104   |                    | TEE       | 340                           | 219.1        |            |       | 2   |         |        |       |      |     |          |                                                     |
| 105   |                    | TUBE/PIPE | 340                           | 219.1        | 4          |       |     |         |        |       |      |     |          |                                                     |
| 106   | MAW20BR005         | VALVE     | 340                           | 21.3         |            |       |     |         | 3      |       |      |     |          |                                                     |
| 107   |                    | TUBE/PIPE | 340                           | 88.9         | 5          |       |     |         |        |       |      |     |          |                                                     |
| 108   |                    | TUBE/PIPE | 340                           | 33.4         | 1          |       |     |         |        |       |      |     |          |                                                     |
| 109   |                    | ELBOW     | 340                           | 88.9         |            | 2     |     |         |        |       |      |     |          |                                                     |
| 110   |                    | BEND      | 340                           | 33.4         |            |       |     |         |        |       | 3    |     |          |                                                     |
| 111   |                    | FLANGE    | 340                           | 88.9         |            |       |     |         | 2      |       |      |     |          |                                                     |
| 112   |                    | REDUCER   | 340                           | 33.4         |            |       |     | 3       |        |       |      |     |          |                                                     |
| 113   | MAW21BR001         | TUBE/PIPE | 470                           | 141.3        | 4          |       |     |         |        |       |      |     |          |                                                     |
| 114   |                    | TUBE/PIPE | 470                           | 114.3        | 2.5        |       |     |         |        |       |      |     |          |                                                     |
| 115   |                    | REDUCER   | 470                           | 141.3        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 116   |                    | FLANGE    | 470                           | 114.3        |            |       |     |         | 2      |       |      |     |          |                                                     |
| 117   |                    | ELBOW     | 470                           | 141.3        |            | 2     |     |         |        |       |      |     |          |                                                     |
| 118   |                    | ELBOW     | 470                           | 114.3        |            | 1     |     |         |        |       |      |     |          |                                                     |
| 119   |                    | BEND      | 470                           | 141.3        |            |       |     |         |        |       | 1    |     |          |                                                     |
| 120   |                    | BEND      | 470                           | 114.3        |            |       |     |         |        |       | 3    |     |          |                                                     |
| 121   | MAW21BR002         | TUBE/PIPE | 470                           | 141.3        | 4          |       |     |         |        |       |      |     |          |                                                     |
| 122   |                    | TUBE/PIPE | 470                           | 114.3        | 2.5        |       |     |         |        |       |      |     |          |                                                     |
| 123   |                    | REDUCER   | 470                           | 141.3        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 124   |                    | FLANGE    | 470                           | 114.3        |            |       |     |         | 2      |       |      |     |          |                                                     |
| 125   |                    | ELBOW     | 470                           | 114.3        |            | 2     |     |         |        |       |      |     |          |                                                     |
| 126   |                    | BEND      | 470                           | 141.3        |            |       |     |         |        |       | 2    |     |          |                                                     |
| 127   |                    | BEND      | 470                           | 114.3        |            |       |     |         |        |       | 3    |     |          |                                                     |
| 128   | MAW21BR003         | TUBE/PIPE | 470                           | 219.1        | 5.5        |       |     |         |        |       |      |     |          |                                                     |
| 129   |                    | TEE       | 470                           | 219.1        |            |       | 1   |         |        |       |      |     |          |                                                     |
| 130   |                    | REDUCER   | 470                           | 219.1        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 131   |                    | BEND      | 470                           | 219.1        |            |       |     |         |        |       | 3    |     |          |                                                     |
| 132   | MAW22BR001         | TUBE/PIPE | 470                           | 219.1        | 6          |       |     |         |        |       |      |     |          |                                                     |
| 133   |                    | TEE       | 470                           | 219.1        |            |       | 1   |         |        |       |      |     |          |                                                     |
| 134   |                    | REDUCER   | 470                           | 219.1        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 135   |                    | BEND      | 470                           | 219.1        |            |       |     |         |        |       | 5    |     |          |                                                     |



**Bill of Materials for Thermal Insulation of TIP  
Seal Steam System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|----------|-----------------------------------------------------|
| 136   | MAW22BR002         | TUBE/PIPE | 470                           | 141.3        | 2.5        |       |     |         |        |       |      |          |                                                     |
| 137   |                    | TUBE/PIPE | 470                           | 114.3        | 2.5        |       |     |         |        |       |      |          |                                                     |
| 138   |                    | REDUCER   | 470                           | 141.3        |            |       |     | 1       |        |       |      |          |                                                     |
| 139   |                    | FLANGE    | 470                           | 114.3        |            |       |     |         | 2      |       |      |          |                                                     |
| 140   |                    | ELBOW     | 470                           | 114.3        |            | 2     |     |         |        |       |      |          |                                                     |
| 141   | MAW22BR003         | TUBE/PIPE | 470                           | 141.3        | 4          |       |     |         |        |       |      |          |                                                     |
| 142   |                    | TUBE/PIPE | 470                           | 114.3        | 2.5        |       |     |         |        |       |      |          |                                                     |
| 143   |                    | REDUCER   | 470                           | 141.3        |            |       |     | 1       |        |       |      |          |                                                     |
| 144   |                    | FLANGE    | 470                           | 114.3        |            |       |     |         | 2      |       |      |          |                                                     |
| 145   |                    | ELBOW     | 470                           | 141.3        |            | 1     |     |         |        |       |      |          |                                                     |
| 146   |                    | ELBOW     | 470                           | 114.3        |            | 2     |     |         |        |       |      |          |                                                     |
| 147   |                    | BEND      | 470                           | 114.3        |            |       |     |         |        |       | 1    |          |                                                     |
| 148   | MAW23BR001         | TUBE/PIPE | 470                           | 141.3        | 6          |       |     |         |        |       |      |          |                                                     |
| 149   |                    | TUBE/PIPE | 470                           | 114.3        | 3          |       |     |         |        |       |      |          |                                                     |
| 150   |                    | REDUCER   | 470                           | 141.3        |            |       |     | 1       |        |       |      |          |                                                     |
| 151   |                    | BEND      | 470                           | 114.3        |            |       |     |         |        |       | 1    |          |                                                     |
| 152   |                    | BEND      | 470                           | 141.3        |            |       |     |         |        |       | 1    |          |                                                     |
| 153   |                    | FLANGE    | 470                           | 114.3        |            |       |     |         | 2      |       |      |          |                                                     |
| 154   |                    | ELBOW     | 470                           | 141.3        |            | 1     |     |         |        |       |      |          |                                                     |
| 155   |                    | ELBOW     | 470                           | 114.3        |            | 1     |     |         |        |       |      |          |                                                     |
| 156   | MAW23BR002         | TUBE/PIPE | 470                           | 141.3        | 1.5        |       |     |         |        |       |      |          |                                                     |
| 157   |                    | TUBE/PIPE | 470                           | 114.3        | 3.5        |       |     |         |        |       |      |          |                                                     |
| 158   |                    | REDUCER   | 470                           | 141.3        |            |       |     | 1       |        |       |      |          |                                                     |
| 159   |                    | FLANGE    | 470                           | 114.3        |            |       |     |         | 2      |       |      |          |                                                     |
| 160   |                    | ELBOW     | 470                           | 114.3        |            | 1     |     |         |        |       |      |          |                                                     |
| 161   |                    | BEND      | 470                           | 114.3        |            |       |     |         |        |       | 1    |          |                                                     |
| 162   |                    | BEND      | 470                           | 141.3        |            |       |     |         |        |       | 2    |          |                                                     |
| 163   | MAW23BR003         | TUBE/PIPE | 470                           | 219.1        | 7.5        |       |     |         |        |       |      |          |                                                     |
| 164   |                    | TEE       | 470                           | 219.1        |            |       | 1   |         |        |       |      |          |                                                     |
| 165   |                    | REDUCER   | 470                           | 219.1        |            |       |     | 1       |        |       |      |          |                                                     |
| 166   |                    | BEND      | 470                           | 219.1        |            |       |     |         |        |       | 4    |          |                                                     |
| 167   | MAW24BR001         | TUBE/PIPE | 470                           | 141.3        | 2.5        |       |     |         |        |       |      |          |                                                     |
| 168   |                    | TUBE/PIPE | 470                           | 114.3        | 1.5        |       |     |         |        |       |      |          |                                                     |
| 169   |                    | REDUCER   | 470                           | 141.3        |            |       |     | 1       |        |       |      |          |                                                     |
| 170   |                    | FLANGE    | 470                           | 114.3        |            |       |     |         | 2      |       |      |          |                                                     |
| 171   |                    | BEND      | 470                           | 141.3        |            |       |     |         |        |       | 2    |          |                                                     |
| 172   |                    | BEND      | 470                           | 114.3        |            |       |     |         |        |       | 2    |          |                                                     |
| 173   | MAW24BR003         | TUBE/PIPE | 470                           | 219.3        | 7.5        |       |     |         |        |       |      |          |                                                     |
| 174   |                    | TEE       | 470                           | 219.3        |            |       | 1   |         |        |       |      |          |                                                     |
| 175   |                    | REDUCER   | 470                           | 219.3        |            |       |     | 1       |        |       |      |          |                                                     |
| 176   |                    | BEND      | 470                           | 219.3        |            |       |     |         |        |       | 6    |          |                                                     |

*(Signature)*





**Bill of Materials for Thermal Insulation of TIP**  
**Seal Steam System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|----------|-----------------------------------------------------|
| 177   | MAW24BR002         | TUBE/PIPE | 470                           | 141.3        | 2.5        |       |     |         |        |       |      |          |                                                     |
| 178   |                    | TUBE/PIPE | 470                           | 114.3        | 1.5        |       |     |         |        |       |      |          |                                                     |
| 179   |                    | REDUCER   | 470                           | 141.3        |            |       |     | 1       |        |       |      |          |                                                     |
| 180   |                    | FLANGE    | 470                           | 114.3        |            |       |     |         | 2      |       |      |          |                                                     |
| 181   |                    | BEND      | 470                           | 114.3        |            |       |     |         |        |       | 2    |          |                                                     |
| 182   |                    | BEND      | 470                           | 141.3        |            |       |     |         |        |       | 3    |          |                                                     |
| 183   | MAW25BR001         | TUBE/PIPE | 340                           | 141.3        | 8          |       |     |         |        |       |      |          |                                                     |
| 184   |                    | TUBE/PIPE | 340                           | 114.3        | 2          |       |     |         |        |       |      |          |                                                     |
| 185   |                    | REDUCER   | 340                           | 141.3        |            |       |     | 1       |        |       |      |          |                                                     |
| 186   |                    | FLANGE    | 340                           | 141.3        |            |       |     |         | 2      |       |      |          |                                                     |
| 187   |                    | BEND      | 340                           | 141.3        |            |       |     |         |        |       | 6    |          |                                                     |
| 188   |                    | BEND      | 340                           | 114.3        |            |       |     |         |        |       | 2    |          |                                                     |
| 189   | MAW26BR001         | TUBE/PIPE | 340                           | 141.3        | 8          |       |     |         |        |       |      |          |                                                     |
| 190   |                    | TUBE/PIPE | 340                           | 114.3        | 2          |       |     |         |        |       |      |          |                                                     |
| 191   |                    | REDUCER   | 340                           | 114.3        |            |       |     | 1       |        |       |      |          |                                                     |
| 192   |                    | FLANGE    | 340                           | 141.3        |            |       |     |         | 2      |       |      |          |                                                     |
| 193   |                    | ELBOW     | 340                           | 141.3        |            | 2     |     |         |        |       |      |          |                                                     |
| 194   |                    | BEND      | 340                           | 114.3        |            |       |     |         |        |       | 2    |          |                                                     |
| 195   |                    | BEND      | 340                           | 141.3        |            |       |     |         |        |       | 4    |          |                                                     |
| 196   | MAW27BR001         | BEND      | 340                           | 141.3        |            |       |     |         |        |       | 5    |          |                                                     |
| 197   |                    | BEND      | 340                           | 114.3        |            |       |     |         |        |       | 2    |          |                                                     |
| 198   |                    | ELBOW     | 340                           | 141.3        |            | 2     |     |         |        |       |      |          |                                                     |
| 199   |                    | FLANGE    | 340                           | 141.3        |            |       |     |         | 2      |       |      |          |                                                     |
| 200   |                    | REDUCER   | 340                           | 141.3        |            |       |     | 1       |        |       |      |          |                                                     |
| 201   |                    | TUBE/PIPE | 340                           | 114.3        | 2          |       |     |         |        |       |      |          |                                                     |
| 202   |                    | TUBE/PIPE | 340                           | 141.3        | 8          |       |     |         |        |       |      |          |                                                     |
| 203   | MAW28BR001         | BEND      | 340                           | 114.3        |            |       |     |         |        |       | 2    |          |                                                     |
| 204   |                    | BEND      | 340                           | 141.3        |            |       |     |         |        |       | 3    |          |                                                     |
| 205   |                    | ELBOW     | 340                           | 141.3        |            | 2     |     |         |        |       |      |          |                                                     |
| 206   |                    | FLANGE    | 340                           | 141.3        |            |       |     |         | 2      |       |      |          |                                                     |
| 207   |                    | REDUCER   | 340                           | 141.3        |            |       |     | 1       |        |       |      |          |                                                     |
| 208   |                    | TUBE/PIPE | 340                           | 114.3        | 2          |       |     |         |        |       |      |          |                                                     |
| 209   |                    | TUBE/PIPE | 340                           | 141.3        | 9          |       |     |         |        |       |      |          |                                                     |
| 210   | MAW50BR003         | TUBE/PIPE | 530                           | 219.3        | 0.5        |       |     |         |        |       |      |          |                                                     |
| 211   |                    | OLET      | 530                           | 219.3        |            |       | 1   |         |        |       |      | 1        |                                                     |
| 212   |                    | FLANGE    | 530                           | 219.3        |            |       |     |         | 2      |       |      |          |                                                     |

*Handwritten signature*



**Bill of Materials for Thermal Insulation of TIP  
Seal Steam System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 213   | MAW50BR001         | VALVE     | 530                           | 457          |            |       |     |         |        | 2     |      |     |          |                                                     |
| 214   |                    | TUBE/PIPE | 530                           | 457          | 3          |       |     |         |        |       |      |     |          |                                                     |
| 215   |                    | TEE       | 530                           | 457          |            |       | 1   |         |        |       |      |     |          |                                                     |
| 216   |                    | OLET      | 530                           | 457          |            |       |     |         |        |       |      |     | 3        |                                                     |
| 217   |                    | REDUCER   | 530                           | 457          |            |       |     | 1       |        |       |      |     |          |                                                     |
| 218   |                    | BEND      | 530                           | 457          |            |       |     |         |        |       | 4    |     |          |                                                     |
| 219   |                    | ELBOW     | 530                           | 457          |            | 1     |     |         |        |       |      |     |          |                                                     |
| 220   | MAW50BR002         | VALVE     | 530                           | 457          |            |       |     |         |        | 1     |      |     |          |                                                     |
| 221   |                    | TUBE/PIPE | 530                           | 457          | 13         |       |     |         |        |       |      |     |          |                                                     |
| 222   |                    | TEE       | 530                           | 457          |            |       | 1   |         |        |       |      |     |          |                                                     |
| 223   |                    | ELBOW     | 530                           | 457          |            | 9     |     |         |        |       |      |     |          |                                                     |
| 224   |                    | BEND      | 530                           | 457          |            |       |     |         |        |       | 4    |     |          |                                                     |
| 225   |                    | VALVE     | 530                           | 457          |            |       |     |         |        | 1     |      |     |          |                                                     |
| 226   | MAW50BR103         | TUBE/PIPE | 530                           | 457          | 1.5        |       |     |         |        |       |      |     |          |                                                     |
| 227   |                    | BEND      | 530                           | 457          |            | 2     |     |         |        |       |      |     |          |                                                     |
| 228   | MAW50BR104         | ELBOW     | 530                           | 457          |            | 3     |     |         |        |       |      |     |          |                                                     |
| 229   |                    | TUBE/PIPE | 530                           | 457          | 1          |       |     |         |        |       |      |     |          |                                                     |
| 230   | MAW60BR001         | TUBE/PIPE | 510                           | 114.3        | 2          |       |     |         |        |       |      |     |          |                                                     |
| 231   |                    | TUBE/PIPE | 510                           | 141.3        | 3          |       |     |         |        |       |      |     |          |                                                     |
| 232   |                    | REDUCER   | 510                           | 141.3        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 233   |                    | ELBOW     | 510                           | 114.3        |            | 1     |     |         |        |       |      |     |          |                                                     |
| 234   |                    | BEND      | 510                           | 141.3        |            |       |     |         |        |       | 2    |     |          |                                                     |
| 235   | MAW60BR002         | TUBE/PIPE | 510                           | 114.3        | 2          |       |     |         |        |       |      |     |          |                                                     |
| 236   |                    | TUBE/PIPE | 510                           | 141.3        | 3          |       |     |         |        |       |      |     |          |                                                     |
| 237   |                    | REDUCER   | 510                           | 141.3        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 238   |                    | BEND      | 510                           | 114.3        |            |       |     |         |        |       | 1    |     |          |                                                     |
| 239   |                    | ELBOW     | 510                           | 114.3        |            | 1     |     |         |        |       |      |     |          |                                                     |
| 240   |                    | BEND      | 510                           | 141.3        |            |       |     |         |        |       | 2    |     |          |                                                     |
| 241   | MAW60BR003         | TUBE/PIPE | 510                           | 168.3        | 5.5        |       |     |         |        |       |      |     |          |                                                     |
| 242   |                    | TEE       | 510                           | 168.3        |            |       | 2   |         |        |       |      |     |          |                                                     |
| 243   |                    | BEND      | 510                           | 219.1        |            |       |     |         |        |       | 2    |     |          |                                                     |
| 244   |                    | ELBOW     | 510                           | 168.3        |            | 1     |     |         |        |       |      |     |          |                                                     |
| 245   |                    | CAP       | 510                           | 168.3        |            |       |     |         |        |       |      | 1   |          |                                                     |
| 246   | MAW60BR004         | TUBE/PIPE | 510                           | 114.3        | 2          |       |     |         |        |       |      |     |          |                                                     |
| 247   |                    | TUBE/PIPE | 510                           | 141.3        | 2.5        |       |     |         |        |       |      |     |          |                                                     |
| 248   |                    | REDUCER   | 510                           | 141.3        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 249   |                    | ELBOW     | 510                           | 114.3        |            | 1     |     |         |        |       |      |     |          |                                                     |
| 250   |                    | BEND      | 510                           | 114.3        |            |       |     |         |        |       | 2    |     |          |                                                     |
| 251   |                    | BEND      | 510                           | 141.3        |            |       |     |         |        |       | 2    |     |          |                                                     |





**Bill of Materials for Thermal Insulation of TIP  
Seal Steam System**

| SI No | TAG No of the Line | ELBOW     | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 252   | MAW60BR005         | TUBE/PIPE | 510                           | 114.3        | 2          |       |     |         |        |       |      |     |          |                                                     |
| 253   |                    | TUBE/PIPE | 510                           | 141.3        | 2.5        |       |     |         |        |       |      |     |          |                                                     |
| 254   |                    | REDUCER   | 510                           | 141.3        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 255   |                    | ELBOW     | 510                           | 114.3        |            | 1     |     |         |        |       |      |     |          |                                                     |
| 256   |                    | BEND      | 510                           | 114.3        |            |       |     |         |        |       | 2    |     |          |                                                     |
| 257   |                    | BEND      | 510                           | 141.3        |            |       |     |         |        |       | 2    |     |          |                                                     |
| 258   | MAW60BR006         | TUBE/PIPE | 510                           | 168.3        | 3          |       |     |         |        |       |      |     |          |                                                     |
| 259   |                    | TEE       | 510                           | 168.3        |            |       | 2   |         |        |       |      |     |          |                                                     |
| 260   |                    | BEND      | 510                           | 168.3        |            |       |     |         |        |       | 1    |     |          |                                                     |
| 261   |                    | CAP       | 510                           | 168.3        |            |       |     |         |        |       |      | 1   |          |                                                     |
| 262   | MAW60BR007         | TUBE/PIPE | 510                           | 219.1        | 2          |       |     |         |        |       |      |     |          |                                                     |
| 263   |                    | TEE       | 510                           | 219.1        |            |       | 2   |         |        |       |      |     |          |                                                     |
| 264   |                    | CAP       | 510                           | 219.1        |            |       |     |         |        |       |      | 1   |          |                                                     |
| 265   |                    | TUBE/PIPE | 420                           | 48.3         | 0.5        |       |     |         |        |       |      |     |          |                                                     |
| 266   | MAW60BR008         | TUBE/PIPE | 420                           | 219.1        | 13.5       |       |     |         |        |       |      |     |          |                                                     |
| 267   |                    | OLET      | 420                           | 219.1        |            |       |     |         |        |       |      |     | 2        |                                                     |
| 268   |                    | TEE       | 420                           | 219.1        |            |       | 1   |         |        |       |      |     |          |                                                     |
| 269   |                    | BEND      | 420                           | 219.1        |            |       |     |         |        |       | 4    |     |          |                                                     |
| 270   |                    | ELBOW     | 420                           | 219.1        |            | 5     |     |         |        |       |      |     |          |                                                     |
| 271   |                    | CAP       | 420                           | 114.3        |            |       |     |         |        |       |      | 1   |          |                                                     |
| 272   |                    | VALVE     | 190                           | 355.6        |            |       |     |         |        | 1     |      |     |          |                                                     |
| 273   | MAW80BR001         | TUBE/PIPE | 190                           | 141.3        | 2          |       |     |         |        |       |      |     |          |                                                     |
| 274   |                    | TUBE/PIPE | 190                           | 355.6        | 34.5       |       |     |         |        |       |      |     |          |                                                     |
| 275   |                    | TEE       | 190                           | 355.6        |            |       | 3   |         |        |       |      |     |          |                                                     |
| 276   |                    | REDUCER   | 190                           | 355.6        |            |       |     | 2       |        |       |      |     |          |                                                     |
| 277   |                    | BEND      | 190                           | 141.3        |            |       |     |         |        |       | 3    |     |          |                                                     |
| 278   |                    | ELBOW     | 190                           | 355.6        |            | 5     |     |         |        |       |      |     |          |                                                     |
| 279   | MAW80BR002         | TUBE/PIPE | 320                           | 323.8        | 5          |       |     |         |        |       |      |     |          |                                                     |
| 280   |                    | TUBE/PIPE | 320                           | 141.3        | 9.5        |       |     |         |        |       |      |     |          |                                                     |
| 281   |                    | TEE       | 320                           | 323.8        |            |       | 2   |         |        |       |      |     |          |                                                     |
| 282   |                    | BEND      | 320                           | 323.8        |            |       |     |         |        |       | 1    |     |          |                                                     |
| 283   |                    | ELBOW     | 320                           | 323.8        |            | 3     |     |         |        |       |      |     |          |                                                     |
| 284   |                    | TUBE/PIPE | 320                           | 273          | 4          |       |     |         |        |       |      |     |          |                                                     |
| 285   | MAW80BR003         | REDUCER   | 320                           | 273          |            |       |     | 1       |        |       |      |     |          |                                                     |
| 286   |                    | TEE       | 320                           | 273          |            |       | 2   |         |        |       |      |     |          |                                                     |
| 287   |                    | CAP       | 320                           | 273          |            |       |     |         |        |       |      | 1   |          |                                                     |
| 288   |                    |           |                               |              |            |       |     |         |        |       |      |     |          |                                                     |

*(Signature)*





**Bill of Materials for Thermal Insulation of TIP  
Seal Steam System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 288   | MAW80BR004         | TUBE/PIPE | 190                           | 33.4         | 0.5        |       |     |         |        |       |      |     |          |                                                     |
| 289   |                    | TUBE/PIPE | 190                           | 273          | 10         |       |     |         |        |       |      |     |          |                                                     |
| 290   |                    | TEE       | 190                           | 273          |            |       | 3   |         |        |       |      |     |          |                                                     |
| 291   |                    | FLANGE    | 190                           | 60.3         |            |       |     |         | 2      |       |      |     |          |                                                     |
| 292   |                    | ELBOW     | 190                           | 273          |            | 7     |     |         |        |       |      |     |          |                                                     |
| 293   | MAW80BR005         | TUBE/PIPE | 190                           | 33.4         | 3          |       |     |         |        |       |      |     |          |                                                     |
| 294   |                    | TEE       | 190                           | 33.4         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 295   |                    | REDUCER   | 190                           | 33.4         |            |       |     | 2       |        |       |      |     |          |                                                     |
| 296   |                    | ELBOW     | 190                           | 33.4         |            | 8     |     |         |        |       |      |     |          |                                                     |
| 297   | MAW80BR006         | TUBE/PIPE | 190                           | 33.4         | 3          |       |     |         |        |       |      |     |          |                                                     |
| 298   |                    | TEE       | 190                           | 33.4         |            |       | 1   |         |        |       |      |     |          |                                                     |
| 299   |                    | REDUCER   | 190                           | 33.4         |            |       |     | 1       |        |       |      |     |          |                                                     |
| 300   |                    | BEND      | 190                           | 33.4         |            | 4     |     |         |        |       |      |     |          |                                                     |
| 301   | MAW80BR007         | ELBOW     | 190                           | 168.3        |            | 3     |     |         |        |       |      |     |          |                                                     |
| 302   |                    | TUBE/PIPE | 190                           | 168.3        | 3          |       |     |         |        |       |      |     |          |                                                     |
| 303   | MAW80BR008         | VALVE     | 190                           | 168.3        |            |       |     |         |        | 1     |      |     |          |                                                     |
| 304   |                    | TUBE/PIPE | 190                           | 168.3        | 3          |       |     |         |        |       |      |     |          |                                                     |
| 305   |                    | TEE       | 190                           | 168.3        |            |       | 1   |         |        |       |      |     |          |                                                     |
| 306   |                    | FLANGE    | 190                           | 168.3        |            |       |     |         | 2      |       |      |     |          |                                                     |
| 307   |                    | ELBOW     | 190                           | 168.3        |            | 4     |     |         |        |       |      |     |          |                                                     |
| 308   |                    | VALVE     | 190                           | 168.3        |            |       |     |         |        | 1     |      |     |          |                                                     |
| 309   | MAW80BR009         | TUBE/PIPE | 190                           | 168.3        | 3          |       |     |         |        |       |      |     |          |                                                     |
| 310   |                    | ELBOW     | 190                           | 168.3        |            | 3     |     |         |        |       |      |     |          |                                                     |
| 311   |                    | FLANGE    | 190                           | 168.3        |            |       |     |         | 2      |       |      |     |          |                                                     |
| 312   |                    | TUBE/PIPE | 190                           | 219.1        | 0.5        |       |     |         |        |       |      |     |          |                                                     |
| 313   | MAW80BR010         | REDUCER   | 190                           | 219.1        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 314   | MAW80BR011         | TUBE/PIPE | 190                           | 219.1        | 0.5        |       |     |         |        |       |      |     |          |                                                     |
| 315   |                    | REDUCER   | 190                           | 219.1        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 316   | MAW80BR012         | TUBE/PIPE | 190                           | 33.4         | 12         |       |     |         |        |       |      |     |          |                                                     |
| 317   |                    | TEE       | 190                           | 219.1        |            |       | 1   |         |        |       |      |     |          |                                                     |
| 318   |                    | BEND      | 190                           | 33.4         |            |       |     |         |        |       | 5    |     |          |                                                     |
| 319   |                    | ELBOW     | 190                           | 219.1        |            | 2     |     |         |        |       |      |     |          |                                                     |
| 320   |                    | FLANGE    | 190                           | 219.1        |            |       |     |         | 2      |       |      |     |          |                                                     |
| 321   |                    | TUBE/PIPE | 190                           | 219.1        | 4          |       |     |         |        |       |      |     |          |                                                     |



**Bill of Materials for Thermal Insulation of TIP  
Seal Steam System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (M) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 322   | MAW80BR013         | TUBE/PIPE | 190                           | 33.4         | 12         |       |     |         |        |       |      |     |          |                                                     |
| 323   |                    | TEE       | 190                           | 219.1        |            |       | 1   |         |        |       |      |     |          |                                                     |
| 324   |                    | BEND      | 190                           | 33.4         |            |       |     |         |        |       | 5    |     |          |                                                     |
| 325   |                    | ELBOW     | 190                           | 219.1        |            | 4     |     |         |        |       |      |     |          |                                                     |
| 326   |                    | FLANGE    | 190                           | 219.1        |            |       |     |         | 2      |       |      |     |          |                                                     |
| 327   |                    | VALVE     | 190                           | 219.1        |            |       |     |         |        | 1     |      |     |          |                                                     |
| 328   |                    | BEND      | 190                           | 219.1        |            |       |     |         |        |       | 1    |     |          |                                                     |
| 329   |                    | TUBE/PIPE | 190                           | 219.1        | 10         |       |     |         |        |       |      |     |          |                                                     |
| 330   | MAW80BR014         | TUBE/PIPE | 190                           | 355.6        | 2          |       |     |         |        |       |      |     |          |                                                     |
| 331   |                    | VALVE     | 190                           | 355.6        |            |       |     |         |        | 1     |      |     |          |                                                     |
| 332   |                    | TEE       | 190                           | 355.6        |            |       | 1   |         |        |       |      |     |          |                                                     |
| 333   |                    | BEND      | 190                           | 355.6        |            |       |     |         |        |       | 1    |     |          |                                                     |
| 334   |                    | ELBOW     | 190                           | 355.6        |            | 2     |     |         |        |       |      |     |          |                                                     |
| 335   | MAW80BR015         | TUBE/PIPE | 190                           | 33.4         | 1.5        |       |     |         |        |       |      |     |          |                                                     |
| 336   |                    | REDUCER   | 190                           | 33.4         |            |       |     | 1       |        |       |      |     |          |                                                     |
| 337   |                    | BEND      | 190                           | 33.4         |            |       |     |         |        |       | 3    |     |          |                                                     |
| 338   | MAW81BR001         | ELBOW     | 320                           | 114.3        |            | 1     |     |         |        |       |      |     |          |                                                     |
| 339   |                    | BEND      | 320                           | 168.3        |            |       |     |         |        |       | 2    |     |          |                                                     |
| 340   |                    | REDUCER   | 320                           | 168.3        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 341   |                    | TUBE/PIPE | 320                           | 114.3        | 2          |       |     |         |        |       |      |     |          |                                                     |
| 342   |                    | TUBE/PIPE | 320                           | 168.3        | 2.5        |       |     |         |        |       |      |     |          |                                                     |
| 343   | MAW81BR002         | ELBOW     | 320                           | 114.3        |            | 1     |     |         |        |       |      |     |          |                                                     |
| 344   |                    | ELBOW     | 320                           | 168.3        |            | 1     |     |         |        |       |      |     |          |                                                     |
| 345   |                    | TUBE/PIPE | 320                           | 168.3        | 2.5        |       |     |         |        |       |      |     |          |                                                     |
| 346   |                    | TUBE/PIPE | 320                           | 114.3        | 2          |       |     |         |        |       |      |     |          |                                                     |
| 347   |                    | REDUCER   | 320                           | 168.3        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 348   |                    | BEND      | 320                           | 168.3        |            |       |     |         |        |       | 1    |     |          |                                                     |
| 349   | MAW81BR003         | VALVE     | 320                           | 219.1        |            |       |     |         |        | 1     |      |     |          |                                                     |
| 350   |                    | BEND      | 320                           | 219.1        |            |       |     |         |        |       | 3    |     |          |                                                     |
| 351   |                    | TUBE/PIPE | 320                           | 219.5        | 6          |       |     |         |        |       |      |     |          |                                                     |
| 352   |                    | TEE       | 320                           | 219.1        |            |       | 1   |         |        |       |      |     |          |                                                     |
| 353   |                    | REDUCER   | 320                           | 219.1        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 354   |                    | FLANGE    | 320                           | 219.1        |            |       |     |         | 2      |       |      |     |          |                                                     |
| 355   | MAW82BR001         | ELBOW     | 320                           | 114.3        |            | 1     |     |         |        |       |      |     |          |                                                     |
| 356   |                    | ELBOW     | 320                           | 168.3        |            | 1     |     |         |        |       |      |     |          |                                                     |
| 357   |                    | BEND      | 320                           | 114.3        |            |       |     |         |        |       | 2    |     |          |                                                     |
| 358   |                    | REDUCER   | 320                           | 168.3        |            |       |     | 1       |        |       |      |     |          |                                                     |
| 359   |                    | BEND      | 320                           | 168.3        |            |       |     |         |        |       | 2    |     |          |                                                     |
| 360   |                    | TUBE/PIPE | 320                           | 114.3        | 1.5        |       |     |         |        |       |      |     |          |                                                     |
| 361   |                    | TUBE/PIPE | 320                           | 168.3        | 1.5        |       |     |         |        |       |      |     |          |                                                     |



**Bill of Materials for Thermal Insulation of TIP  
Seal Steam System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (mm) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|-------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 362   | MAW82BR002         | BEND      | 320                           | 114.3        |             |       |     |         |        |       | 3    |     |          |                                                     |
| 363   |                    | BEND      | 320                           | 168.3        |             |       |     |         |        |       | 2    |     |          |                                                     |
| 364   |                    | ELBOW     | 320                           | 114.3        |             | 1     |     |         |        |       |      |     |          |                                                     |
| 365   |                    | REDUCER   | 320                           | 168.3        |             |       |     | 1       |        |       |      |     |          |                                                     |
| 366   |                    | TUBE/PIPE | 320                           | 114.3        | 1.5         |       |     |         |        |       |      |     |          |                                                     |
| 367   |                    | TUBE/PIPE | 320                           | 168.3        | 1.5         |       |     |         |        |       |      |     |          |                                                     |
| 368   | MAW82BR003         | ELBOW     | 320                           | 219.1        |             | 2     |     |         |        |       |      |     |          |                                                     |
| 369   |                    | TUBE/PIPE | 320                           | 219.1        | 7           |       |     |         |        |       |      |     |          |                                                     |
| 370   |                    | REDUCER   | 320                           | 219.1        |             |       | 1   |         |        |       |      |     |          |                                                     |
| 371   |                    | FLANGE    | 320                           | 219.1        |             |       |     |         | 2      |       |      |     |          |                                                     |
| 372   |                    | BEND      | 320                           | 219.1        |             |       |     |         |        |       | 2    |     |          |                                                     |
| 373   |                    | TEE       | 320                           | 219.1        |             |       | 1   |         |        |       |      |     |          |                                                     |
| 374   |                    | VALVE     | 320                           | 219.1        |             |       |     |         |        | 1     |      |     |          |                                                     |
| 375   |                    | FLANGE    | 320                           | 168.3        |             |       |     |         | 2      |       |      |     |          |                                                     |
| 376   | MAW83BR001         | BEND      | 320                           | 114.3        |             |       |     |         |        |       | 2    |     |          |                                                     |
| 377   |                    | BEND      | 320                           | 141.3        |             |       |     |         |        |       | 5    |     |          |                                                     |
| 378   |                    | REDUCER   | 320                           | 141.3        |             |       | 1   |         |        |       |      |     |          |                                                     |
| 379   |                    | TUBE/PIPE | 320                           | 141.3        | 5.5         |       |     |         |        |       |      |     |          |                                                     |
| 380   |                    | TUBE/PIPE | 320                           | 114.3        | 1.5         |       |     |         |        |       |      |     |          |                                                     |
| 381   | MAW84BR001         | VALVE     | 320                           | 141.3        |             |       |     |         |        | 1     |      |     |          |                                                     |
| 382   |                    | FLANGE    | 320                           | 141.3        |             |       |     |         | 2      |       |      |     |          |                                                     |
| 383   |                    | TUBE/PIPE | 320                           | 141.3        | 7           |       |     |         |        |       |      |     |          |                                                     |
| 384   |                    | TUBE/PIPE | 320                           | 114.3        | 1.5         |       |     |         |        |       |      |     |          |                                                     |
| 385   |                    | REDUCER   | 320                           | 141.3        |             |       | 1   |         |        |       |      |     |          |                                                     |
| 386   |                    | VALVE     | 320                           | 141.3        |             |       |     |         |        | 1     |      |     |          |                                                     |
| 387   |                    | BEND      | 320                           | 141.3        |             |       |     |         |        |       | 2    |     |          |                                                     |
| 388   |                    |           |                               |              |             |       |     |         |        |       |      |     |          |                                                     |
| 389   | MAW85BR001         | BEND      | 190                           | 88.9         |             |       |     |         |        |       | 3    |     |          |                                                     |
| 390   | MAW85BR002         | TUBE/PIPE | 190                           | 88.9         | 2           |       |     |         |        |       |      |     |          |                                                     |
| 391   |                    | BEND      | 190                           | 141.3        |             |       |     |         |        |       | 3    |     |          |                                                     |
| 392   |                    | FLANGE    | 190                           | 141.3        |             |       |     |         | 2      |       |      |     |          |                                                     |
| 393   |                    | REDUCER   | 190                           | 141.3        |             |       | 1   |         |        |       |      |     |          |                                                     |
| 394   |                    | TUBE/PIPE | 190                           | 141.3        | 1           |       |     |         |        |       |      |     |          |                                                     |
| 395   | MAW86BR001         | VALVE     | 190                           | 141.3        |             |       |     |         |        | 1     |      |     |          |                                                     |
| 396   |                    | TUBE/PIPE | 190                           | 88.9         | 1.5         |       |     |         |        |       | 5    |     |          |                                                     |
| 397   |                    | BEND      | 190                           | 88.9         |             |       |     |         |        |       |      |     |          |                                                     |

27







**Bill of Materials for Thermal Insulation of TIP  
Seal Steam System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (Nl) | Length (mm) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | CAP | WELDOLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|-------------|-------|-----|---------|--------|-------|------|-----|----------|-----------------------------------------------------|
| 397   | MAW86BR002         | REDUCER   | 190                           | 141.3        |             |       |     | 1       |        |       |      |     |          |                                                     |
| 398   |                    | FLANGE    | 190                           | 141.3        |             |       |     |         | 2      |       |      |     |          |                                                     |
| 399   |                    | VALVE     | 190                           | 141.3        |             |       |     |         |        | 1     |      |     |          |                                                     |
| 400   |                    | TUBE/PIPE | 190                           | 141.3        | 1           |       |     |         |        |       |      |     |          |                                                     |
| 401   |                    | BEND      | 190                           | 141.3        |             |       |     |         |        |       | 1    |     |          |                                                     |
| 402   | MAW87BR001         | BEND      | 190                           | 88.9         |             |       |     |         |        |       | 3    |     |          |                                                     |
| 403   |                    | TUBE/PIPE | 190                           | 88.9         | 1.5         |       |     |         |        |       |      |     |          |                                                     |
| 404   |                    | ELBOW     | 190                           | 141.3        |             | 1     |     |         |        |       |      |     |          |                                                     |
| 405   | MAW87BR002         | FLANGE    | 190                           | 141.3        |             |       |     |         | 2      |       |      |     |          |                                                     |
| 406   |                    | VALVE     | 190                           | 141.3        |             |       |     |         |        | 1     |      |     |          |                                                     |
| 407   |                    | REDUCER   | 190                           | 141.3        |             |       |     | 1       |        |       |      |     |          |                                                     |
| 408   |                    | TUBE/PIPE | 190                           | 88.9         | 1           |       |     |         |        |       |      |     |          |                                                     |
| 409   |                    | TUBE/PIPE | 190                           | 141.3        | 2           |       |     |         |        |       |      |     |          |                                                     |
| 410   |                    | BEND      | 190                           | 88.9         |             |       |     |         |        |       | 3    |     |          |                                                     |
| 411   | MAW88BR001         | TUBE/PIPE | 190                           | 88.9         | 1           |       |     |         |        |       |      |     |          |                                                     |
| 412   | MAW88BR002         | REDUCER   | 190                           | 141.3        |             |       |     | 1       |        |       |      |     |          |                                                     |
| 413   |                    | FLANGE    | 190                           | 141.3        |             |       |     |         | 2      |       |      |     |          |                                                     |
| 414   |                    | VALVE     | 190                           | 141.3        |             |       |     |         |        | 1     |      |     |          |                                                     |
| 415   |                    | TUBE/PIPE | 190                           | 141.3        | 1.5         |       |     |         |        |       |      |     |          |                                                     |
| 416   |                    | BEND      | 190                           | 141.3        |             |       |     |         |        |       | 2    |     |          |                                                     |

**Bill of Materials for Thermal Insulation of Tip  
Overload Piping System**

| Sl No | TAG No of the Line | TYPE      | Operating Temperature (deg C) | Pipe OD (mm) | Length (m) | ELBOW | TEE | REDUCER | FLANGE | VALVE | BEND | OLET | Insulation Thickness (mm)<br>To be filled by vendor |
|-------|--------------------|-----------|-------------------------------|--------------|------------|-------|-----|---------|--------|-------|------|------|-----------------------------------------------------|
| 1     | MAA14BR001         | TUBE/PIPE | 565                           | 219.1        | 16         |       |     |         |        |       | 8    |      |                                                     |
| 2     |                    | TUBE/PIPE | 565                           | 60.3         | 0.5        |       |     |         |        |       |      |      |                                                     |
| 3     |                    | WELDOLET  | 565                           | 60.3         |            |       |     |         |        |       |      | 2    |                                                     |
| 4     |                    | ELBOW     | 565                           | 60.3         |            | 1     |     |         |        |       |      |      |                                                     |
| 5     | MAA14BR002         | TUBE/PIPE | 565                           | 219.1        | 13         |       | 1   |         |        |       | 8    |      |                                                     |
| 6     |                    | TUBE/PIPE | 565                           | 60.3         | 1          | 1     |     |         |        |       |      |      |                                                     |
| 7     |                    | WELDOLET  | 565                           | 60.3         |            |       |     |         |        |       |      | 2    |                                                     |
| 8     |                    | TUBE/PIPE | 512                           | 168.3        | 4          | 2     |     |         |        |       |      |      |                                                     |
| 9     | MAA14BR003         | WELDOLET  | 512                           | 168.3        |            |       |     |         |        |       |      | 1    |                                                     |
| 10    |                    | TUBE/PIPE | 512                           | 219.1        | 9          | 5     |     | 1       |        |       |      |      |                                                     |
| 11    |                    | VALVE     | 512                           | 33.4         |            |       |     |         |        | 2     |      |      |                                                     |
| 12    |                    | WELDOLET  | 512                           | 33.4         |            |       |     |         |        |       |      | 1    |                                                     |
| 13    |                    | REDUCER   | 512                           | 33.4         |            |       |     | 1       |        |       |      |      |                                                     |
| 14    |                    | TUBE/PIPE | 512                           | 33.4         | 1          |       |     |         |        |       |      |      |                                                     |
| 15    |                    | VALVE     | 512                           | 33.4         |            |       |     |         |        | 2     |      |      |                                                     |
| 16    |                    | TUBE/PIPE | 512                           | 33.4         | 1          |       |     | 1       |        |       |      | 1    |                                                     |
| 17    | MAA14BR004         | TUBE/PIPE | 512                           | 168.3        | 4          | 3     |     |         |        |       |      | 1    |                                                     |
| 18    |                    | TUBE/PIPE | 512                           | 219.1        | 14         | 6     |     | 1       |        |       | 1    |      |                                                     |

**General Notes for Seal Steam, Turbine Drainage & Overload Piping System:**

1. This BOM may vary by +/- 3%.
2. TEEs and Reducers are not included in pipe length and are to be considered separately for Thermal Insulation as per the above table. This supercedes Clause 2.5 of ST29005 in this regard.
3. This BOM consists of total 20 (Twenty) pages. Turbine Drainage System = 6 Pages, Seal Steam System = 12 Pages & Overload Piping System = 2 Page.





24

| SPECIAL INSTRUCTIONS: |                                                                                                                                                                          |                                                          |
|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| SI No                 | BHEL REQUIREMENTS                                                                                                                                                        | VENDOR'S CHECKPOINT (To be filled by Vendor)<br>[YES/NO] |
| 1                     | Vendor has indicated insulation thicknesses for all items covered in this document.                                                                                      |                                                          |
| 2                     | Vendor has considered design criteria as per doc no 412114V3000 & ST29005 REV_04.                                                                                        |                                                          |
| 3                     | Vendor has furnished Sample Calculations for min 10 different cases.                                                                                                     |                                                          |
| 4                     | Vendor has furnished k-values of insulation mattresses at different mean temperatures ranging from 100-300 °C.                                                           |                                                          |
| 5                     | Vendor has furnished BOM containing breakup of quantity of mattresses (in m <sup>2</sup> ) & Aluminium (in kg, for 18, 20 & 22 SWG separately) in their standard format. |                                                          |

Checklist for Vendors

PREPARED BY: NAVNEET (Sr Engr-PED)

APPROVED BY: Sh S K GUPTA (AGM-PED)

*Dr. Navneet*

Seal and Signature of Vendor

*Dr.*



Project Engineering Department  
HEEP, Haridwar

DOC.NO. 412114V3000  
REV.NO. 00  
DATE: 27.10.2016

**THERMAL INSULATION SCHEDULE FOR TG INTEGRAL PIPING**

**PROJECT:** 800 MW

**PROJECT STAGE:** CONTRACT

**SPEC.NO.** ST29005 Rev\_04

**DESIGN PARAMETERS:**

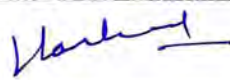
- COLD FACE TEMPERATURE: 60 DEG C
- AMBIENT TEMPERATURE: 45 DEG C
- EMISSIVITY OF AL. SHEET: 0.2
- WIND VELOCITY: 1 M/S
- ASBESTOS USE IN INSULATION IS NOT PERMITTED.

**MATERIALS:**

- INSULATION MATERIAL: LIGHTLY RESIN BONDED ROCKWOOL  
AS PER IS: 8183
- DENSITY: 1. 100 kg/m<sup>3</sup> FOR HOT FACE TEMP. ≤ 400°C  
2. 150 kg/m<sup>3</sup> FOR HOT FACE TEMP. > 400°C
- CLADDING MATERIAL: ALUMINIUM SHEET

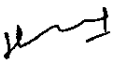
**DESIGN HEAT LOSS AT  
CLADDING SURFACE:**

AS PER ASTM C 680-89.

| Prepared by                                                                         | Approved by                                                                           |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------|
|  |  |
| Navneet Chakrapani<br>Sr Engineer- PED                                              | S K Gupta<br>AGM/PED                                                                  |



|                                                                                                                                                                                                                      |                                              |                                                                                                                                    |                                                |                                          |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|------------------------------------------|
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                  |                                              | <b>उत्पाद मानक</b><br><br><b>STEAM TURBINE ENGINEERING<br/>PRODUCT STANDARD</b>                                                    | <b>ST 29005</b>                                |                                          |
|                                                                                                                                                                                                                      |                                              |                                                                                                                                    | पृष्ठ 23 का 1<br>Page 1 of 23                  |                                          |
| समीची सूची संख्या को<br>अधिकृतित करता है                                                                                                                                                                             | SUPERSEDES<br>INVENTORY NO.                  | BASED ON:<br>BHEL EXPERIENCE                                                                                                       |                                                |                                          |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company. |                                              | <div style="text-align: center;"> <p>SPECIFICATION FOR<br/>THERMAL INSULATION</p> <p>FOR T.G.INTEGRAL<br/>PIPING SYSTEM</p> </div> |                                                |                                          |
| स्वत्वाधिकार एवं गोपनीय<br>इस प्रलेख की कोई भी प्रतिलिपि भारत के बिना हस्तक्षेप के सम्पत्ति है इसका प्रयोग अन्यथा रूप से किसी भी तरह प्रयोग जो कि कंपनी के हित में सम्पत्तिकारक हो न किया जाए।                       |                                              |                                                                                                                                    |                                                |                                          |
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE<br>1-12-03                                                                                                                                                                       | दिनांक एवं हस्ताक्षर<br>SIGNATURE & DATE     |                                                                                                                                    |                                                |                                          |
| समीची सूची संख्या<br>INVENTORY NO.<br>P-5788                                                                                                                                                                         | समीची सूची संख्या<br>INVENTORY NO.<br>P-5788 | अनुवादक<br>TRANSLATED BY<br>QAX<br>S.S. CHAUHAN                                                                                    | निर्माणकर्ता<br>WORKED BY<br>TSX<br>KISHAN LAL | जांचकर्ता<br>CHECKED BY<br>V.K.GUPTA     |
| सहमत विभाग<br>AGREED DEPTT.                                                                                                                                                                                          | नाम<br>NAME                                  | दिनांक एवं हस्ताक्षर<br>DATE & SIGNATURE                                                                                           | पर्यवेक्षणकर्ता<br>SUPERVISED BY<br>V.K.GUPTA  | दिनांक एवं हस्ताक्षर<br>SIGNATURE & DATE |
| REV.NO. 04<br>Dt. 04.02.05                                                                                                                                                                                           |                                              | स्वीकृति<br>APPROVED : (B.K. BHALLA) AGM (STE)                                                                                     |                                                |                                          |
| निर्माण<br>PREPARED : STE                                                                                                                                                                                            |                                              | जारी<br>ISSUED : STE (TL)                                                                                                          |                                                |                                          |
| दिनांक<br>DATE : 1-6-89                                                                                                                                                                                              |                                              | दिनांक<br>DATE : 12-11-03                                                                                                          |                                                |                                          |

|                                                                                                                                                                                                                      |                             |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |                                                   |                                                                                                |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|---------------------------------------------------|------------------------------------------------------------------------------------------------|
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                  |                             |  | उत्पाद मानक<br><b>PRODUCT STANDARD</b><br><b>STEAM TURBINE ENGINEERING</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                           | <b>ST29005</b><br>पृष्ठ 23 का 02<br>Page 02 of 23 |                                                                                                |
| सामग्री सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                 | SUPERSEDES<br>INVENTORY NO. | सामग्री सूची संख्या को<br>अधिकृतित करता है                                        | 1.0 <u>INTRODUCTION</u><br><br>In a thermal power station, thermal insulation of all piping carrying hot fluids is essential for heat economy and protection of operating personnel. In any pipe which is at a temperature higher than its surroundings will loose heat and the amount of heat lost will depend upon the temperature of the fluid conveyed and the thermal conductivity of the piping material. The heat lost through bare pipes increases with:<br>(a) Increase in the temperature of fluid conveyed.<br>(b) Air velocity of the surroundings.<br>Providing proper and adequate insulation on to the facilities and equipments controls heat transfer and maintain the required skin temperature. The use of high quality insulation can return 20% or more per year on the investment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                           |                                                   |                                                                                                |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company |                             |                                                                                   | 2.0 <u>SCOPE</u><br><br>This specifications covers the design, technical requirements and essential particulars for the supply, application & finishing of the thermal insulation complete with all auxiliary materials for the integral piping systems for thermal power stations. Thermal insulation will be applied over integral steam piping having a rated operated temperature of above 60°C for the protection of the operating person & for energy conservation.<br>2.1 The scope of supply shall be defined in data sheet of the project.<br>(a) The description of the components to be insulated.<br>(b) Maximum continuous operating temperature of the components.<br>(c) Design ambient temperature.<br>(d) Type of insulation ordered.<br>(e) Cold face temperature of the insulation above ambient.<br>(f) Other instruction and notes concerning the design, manufacture and supply of Insulation.<br>2.2 Attachment, devices & accessories shall form the part of the scope of supply.<br>2.3 Application of the insulation shall be done at site after consultation with or at the request of the chief of the erection group of BHEL at site.<br>2.4 In case the requirements specified in the data sheet for a particular project are different than what is given in this specification, the data sheet requirements shall be considered as final and binding for that project.<br>2.5 The pipe lengths given in data of the insulation schedule are inclusive of the equivalent length of tees/stub and reducer. The vertical / near vertical runs of piping are included in the pipe length given in the data of insulation schedule. Additional supporting arrangements are required for insulation on vertical / near vertical piping. The bidder should include the charges for these supporting arrangements in the contract cost based on his experience. No breakup of vertical and horizontal runs are to be furnished to the bidder. |                           |                                                   |                                                                                                |
| स्वत्वाधिकार एवं गोपनीय<br>इस प्रलेख में दी गई सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए।                   |                             |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |                                                   |                                                                                                |
| हस्ताक्षर एवं दिनांक<br>SIGN & DATE                                                                                                                                                                                  | 11/11/03                    |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |                                                   |                                                                                                |
| सामग्री सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                 | P-5788                      | REV. NO.<br>04                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | निर्माणकर्ता<br>WORKED BY | S.K.G.                                            |  12.11.03 |
|                                                                                                                                                                                                                      |                             |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | जांचकर्ता<br>CHECKED BY   | V.K.G.                                            |  12.11.03 |



|                                                                                                                                                                                                    |  |                                                                                   |  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |                                                 |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-------------------------------------------------|--|
| चिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                |  |  |  | <b>उत्पाद मानक</b><br><br><b>STEAM TURBINE ENGINEERING<br/>PRODUCT STANDARD</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  | <b>ST29005</b><br>पृष्ठ 23 का 3<br>Page 3 of 23 |  |
| सामग्री सूची संख्या<br>INVENTORY NO.<br>P-5738                                                                                                                                                     |  | सुपरसेडस<br>INVENTORY NO.<br>04                                                   |  | <p>2.6 Data furnished for the items to be insulated is based on pipe erection drawings. No physical measurement of insulation work will be done. The conversion factors for the valve and fittings will be taken from IS:14164.</p> <p>3.0 <b>DESIGN AND PERFORMANCE REQUIREMENTS</b></p> <p>3.1 For the design of the insulation shall be assumed that the surface temperature of the equipment is taken equal to the temperature of the steam. Heat loss at the surface of insulation shall not exceed 180 Kcal / m<sup>2</sup>h unless specified in data sheet.</p> <p>3.2 In principal all the equipments operating above 60°C shall be insulated. However the contractor shall be guided by BHEL regarding the scope as per clause No.2.</p> <p>3.3 If the ambient temperature is not specified in the data sheet, the same shall be assumed as 40°C.</p> <p>3.4 Insulation thickness shall be completed based on the design parameters given in data sheet of the project. The thickness given in insulation schedule shall be reviewed by the bidder.</p> <p>3.5 Insulation shall be supplied in thickness 25, 40, 50, 65 and 75mm. Higher thickness shall be made up in multiple layers from them. The breakup of thickness of multiple layers is given under the column insulation thickness in the insulation schedule.</p> <p>4.0 <b>MATERIALS</b></p> <p>4.1 <b>INSULATING MATERIALS</b></p> <p>The insulating materials and protective covering shall be new and fresh, incombustible, non-hygroscopic and shall be guaranteed to withstand continuously and without deterioration the maximum temperature to which they will be subjected under the specified application. The insulation material and any component of the finished insulation job shall not react chemically by itself or in combination with water or moisture to form the substances which are more actively corrosive to the applied surfaces than water or moisture alone. The material shall not offer substance to fungus or vermin and must not pose a health hazard. The bidder shall submit with the bid the details of application of protective coatings or other methods he proposes to use for corrosion protection of insulated surface.</p> |  |                                                 |  |
| स्वत्वाधिकार एवं गोपनीय<br>इस प्रलेख में कोई भी सूचना भारत देशी इलेक्ट्रिकल्स की संपत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह उपयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए। |  |                                                                                   |  | COPYRIGHT AND CONFIDENTIAL<br>The information on this documents is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |                                                 |  |
| चिनांक एवं हस्ताक्षर<br>SIGN & DATE<br>14.8.04                                                                                                                                                     |  | चिनांक एवं हस्ताक्षर<br>SIGN & DATE<br>14.8.04                                    |  | REV. NO.<br>04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |                                                 |  |
| निर्माणकर्ता<br>WORKED BY<br>S.K.G.                                                                                                                                                                |  | जांचकर्ता<br>CHECKED BY<br>V.K.G.                                                 |  | 7/7/04<br>7.7.04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |                                                 |  |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |                                                                                                                                                                         |                                                                                   |                                                             |              |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------|--------------|
| SIGN & DATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SIGN & DATE                 | SIGN & DATE                                                                                                                                                             |  | <b>PRODUCT STANDARD</b><br><b>STEAM TURBINE ENGINEERING</b> | ST 29005     |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |                                                                                                                                                                         |                                                                                   |                                                             | PAGE 4 OF 23 |
| SUPERSEDES<br>INVENTORY No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | SUPERSEDES<br>INVENTORY No. | <p>The material of insulation used for mattress shall be bonded mineral (rock) as per IS8183.</p> <p>If Preformed pipe section are used, it shall be as per IS9842.</p> |                                                                                   |                                                             |              |
| <p><b>4.2 SHEATHING MATERIAL</b></p> <p>The sheathing material for all insulated piping &amp; equipment shall be aluminium sheet confirming to IS 737. Unless otherwise specified in Data sheet, the thickness of aluminium sheathing to be used shall be as follows:</p> <p>a) Pipes of 450 mm (18 inch.) and above; over outside diameter of insulation :- 1.219 mm (18 SWG).</p> <p>b) Pipes of 150 mm (6 inch) and above; over outside diameter of insulation :- 0.914 mm (20 SWG).</p> <p>c) Pipes less than 150 mm (6 inch); over outside diameter of insulation :- 0.711 mm (22 SWG)</p> |                             |                                                                                                                                                                         |                                                                                   |                                                             |              |
| <p><b>4.3 BINDING &amp; LACING WIRE</b></p> <p>Binding &amp; lacing wire shall be 20 SWG galvanized steel wire. Where interface temperature is 400°C or more, the binding wire shall be 20 SWG stainless steel wire.</p>                                                                                                                                                                                                                                                                                                                                                                        |                             |                                                                                                                                                                         |                                                                                   |                                                             |              |
| <p><b>4.4 STRAPS &amp; BANDS</b></p> <p>All straps &amp; bands shall be galvanized steel. For securing aluminium sheathing material, stainless steel or anodized aluminium bands shall be used. Bands shall be 20 mm wide &amp; 0.6 mm thick.</p>                                                                                                                                                                                                                                                                                                                                               |                             |                                                                                                                                                                         |                                                                                   |                                                             |              |
| <p><b>4.5 SCREWS</b></p> <p>Screws shall be of self tapping type &amp; shall be cadmium/zinc plated.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                             |                                                                                                                                                                         |                                                                                   |                                                             |              |
| <p><b>5.0 APPLICATION OF INSULATION</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |                                                                                                                                                                         |                                                                                   |                                                             |              |
| <p><b>5.1 GENERAL</b></p> <p>The application of thermal insulation is highly skilled job contrary to the general belief. Badly fitted/laid insulation can lead to greater heat loss or surface</p>                                                                                                                                                                                                                                                                                                                                                                                              |                             |                                                                                                                                                                         |                                                                                   |                                                             |              |
| INVENTORY No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | INVENTORY No.               | INVENTORY No.                                                                                                                                                           | REV. No.                                                                          | WORKED BY:—                                                 | CHECKED BY:— |
| P-5788                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | P-5788                      | 22/6/89                                                                                                                                                                 | 04                                                                                | Rizam                                                       | Shinde       |

COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.



|                                                                                                                                                                                         |                             |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                 |                          |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|--------------------------|--|
| SIGN & DATE                                                                                                                                                                             | SIGN & DATE                 | SIGN & DATE                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>PRODUCT STANDARD</b><br><br><b>STEAM TURBINE ENGINEERING</b> | ST 29005                 |  |
|                                                                                                                                                                                         |                             |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                 | PAGE 5 OF 23             |  |
| SUPERSEDES<br>INVENTORY No.                                                                                                                                                             | SUPERSEDES<br>INVENTORY No. | SUPERSEDES<br>INVENTORY No. | <p>temperature than that estimated &amp; also to constant maintenance. Ample provision shall be made for maximum possible thermal movement &amp; the insulation shall be applied in a manner which will avoid breaking or telescoping due to alternate periods of expansion &amp; contraction. A single layer of insulation shall not be more than 75 mm thick.</p> <p>The following are some of the points to be considered in the application of insulation</p> <p>a) Surfaces must be clean, dry, &amp; free from grease, loose scale, moisture etc. before application of insulation.</p> <p>b) Insulation thickness on flanges &amp; valves should be equal to that of the adjacent/associated pipes.</p> <p>c) Where contamination by chemicals or oil spillage is possible, it is important that precaution be taken to avoid contamination of insulation.</p> <p>d) Pipe hangers &amp; supports and any penetrations should be covered in such a way that moisture cannot penetrate.</p> <p>e) The bare insulation must be stored in a proper place (indoor) to avoid contamination which will lead to change in weight &amp; thermal conductivity values.</p> <p>f) Rigid sections should have staggered joints where more than one layer is involved &amp; they must be held in close contact with pipe &amp; fitting face by means of wire or bands.</p> <p><b>5.2 PIPING :-</b></p> <p><b>5.2.1</b> For insulation of piping with preformed pipe sections the same shall be applied over the pipe and finally insulation shall be held in position with 15 mm wide aluminium band at not greater than 400 mm spacing.</p> <p><b>5.2.2</b> For insulation of piping with mattresses having backing GI wire or SS wire netting, the required lengths &amp; shapes are cut from the blankets &amp; wrapped on the piping with edges pulled together tightly at the longitudinal joint and secured by lacing wire &amp; this joint shall be at lower side.</p> <p>If the interface temperature is 400°C or more the wire netting shall be from 20 SWG stainless steel wire and having hexagonal opening of 25 mm size. Otherwise each layer of mattress shall have GI wire netting from 20 SWG &amp; having hexagonal opening of 25 mm size. The ends of all wire loops shall be firmly twisted together with pliers, bent over &amp; carefully pressed into the surface of the insulation.</p> <p>Preformed insulation &amp; mattress insulation on vertical or near vertical piping must be supported in position by means of metal rings &amp; at intervals as per enclosed sketches.</p> <p>GI band/Aluminium bands are to be used for tightly securing the different layers of insulation.</p> <p><b>5.2.3</b> Piping bends shall be insulated to the same specification as adjacent straight piping and should form a smooth external surface. Where preformed material is used, it</p> |                                                                 |                          |  |
| The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company. | COPYRIGHT AND CONFIDENTIAL  | SIGN & DATE<br>27/6/89      | INVENTORY No.<br>P. 5788                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | REV.<br>No.<br>04                                               | WORKED BY:— <i>Rigam</i> |  |
|                                                                                                                                                                                         |                             |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | CHECKED BY:— <i>Sharma</i>                                      |                          |  |

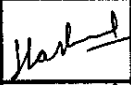
|                                                                                                                                                                                                                       |                          |                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                 |                                            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------|
| SIGN & DATE                                                                                                                                                                                                           | SIGN & DATE              | SIGN & DATE              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>PRODUCT STANDARD</b><br><br><b>STEAM TURBINE ENGINEERING</b> | FORM                                       |
|                                                                                                                                                                                                                       |                          |                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                 | <b>ST 29005</b><br><br><b>PAGE 6 OF 23</b> |
| SUPERSEDES INVENTORY No.                                                                                                                                                                                              | SUPERSEDES INVENTORY No. | SUPERSEDES INVENTORY No. | <p>should be cut lobster back finish and wired or strapped into position.</p> <p>5.2.4 All insulation shall be protected by an outer covering of aluminium sheathing. All insulation sheathing joints shall be sealed and made effectively weather &amp; waterproof. All flat surfaces shall be adequately sloped to prevent pools of water collecting. The sheathing shall be protected internally with two coats of anti corrosive paint as per IS 158. The jackets shall be installed with the longitudinal lap joint at 45° below the horizontal for horizontal pipes and the joints sealed with sealing compound.</p> <p>Arrangements for securing the metal finish over the insulation shall ensure that direct metal contact between the insulated surface and outer metal cladding is avoided. 4 mm thick asbestos board packing shall be used as interfaces to thermally isolate the metal covering from supporting arrangements. There shall be over lapping of 50 mm on both longitudinal &amp; circumferential joints. The screws shall be provided at not greater than 150 mm spacing. Sealing compound is to be applied at all sheathing joints. The overlapping in outer casing should always be at the bottom for horizontal piping so that no rain water enters into the insulation through the joints &amp; the lapping must be done so that water will have a natural drainage. In case of vertical &amp; inclined piping, circumferential overlapping is made such that no rain water enters into the insulation through the joints by proper lapping sequence.</p> <p>5.2.5 All joints in the insulation shall be staggered. For multiple layers of insulation the different layers shall be applied so that the butt joints of one layer do not coincide with those of the other layer.</p> <p>6.0 VALVES &amp; FLANGES INSULATION</p> <p>-----</p> <p>The insulation on all valves &amp; flanged joints shall be enclosed in a removable jacketing so that it may be removed without disturbing the concerned equipment or piping. The thickness of insulation shall be same as that of the pipe line in which these valves and fittings are located. A typical arrangements shown in drawing at sheet no 15.</p> <p>7.0 GENERAL INSTRUCTIONS FOR ERECTION OF INSULATION</p> <p>-----</p> <p>a) Persons doing the actual job can alter the method of fixing of sheet metal as and when necessary, only after consulting the concerned field engineer.</p> <p>b) Care shall be taken to see that the flexible insulation mattresses are not unduly compressed.</p> <p>c) The day to day insulation works are covered by sheathing or with suitable protective materials to prevent the rain water entry.</p> |                                                                 |                                            |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company. |                          |                          | INVENTORY No. P-5788<br>REV. NO. 04<br>WORKED BY:— <i>Rigam</i><br>CHECKED BY:— <i>Shunda</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                 |                                            |



| SIGN & DATE                                                                                                                                                                                                                   | SIGNATURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | DATE        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>PRODUCT STANDARD</b><br><br><b>STEAM TURBINE ENGINEERING</b> | ST 29005     |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|--------------|-----------------------------|-----------|-------------|-------------|------------|----|----|----|----|----|-----|----|----|----|----|-----|----|----|----|----|-----|----|----|----|----|-----|----|----|----|----|-----|----|----|----|----|-----|----|----|----|----|-----|----|----|----|----|
|                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                 | PAGE 7 OF 23 |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| SUPERSEDES INVENTORY No.                                                                                                                                                                                                      | <p>d) The indicated insulation thickness are minimum requirements which should be maintained, and are based on LRB mattresses. If the bidder desires to use pipe section or combination of pipe section &amp; LRB mattresses, the same should be done after prior approval of design engineer.</p> <p>e) Where junctions between bodies of different diameter occur and difference of insulation thickness is specified, the greater thickness is to be continued for a length equal to one diameter of the smaller body and then smoothly tapered to the required smaller thickness over a length equal to two diameters of the smaller body.</p> <p>f) Once the insulation is laid walking on the insulated pipe should be avoided. Suitable scaffoldings are to be used. Similarly slinging of pipes over the insulation should be avoided.</p> <p>g) The layers** of wool mattresses to be adopted, to obtain the specified insulation thickness, are as per table below unless otherwise specified</p> |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                 |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| <p>Copyright and Confidential<br/>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.</p> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                 |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| SIGN & DATE                                                                                                                                                                                                                   | SIGNATURE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | DATE        | <table border="1"> <thead> <tr> <th>Thickness of insulation(mm)</th> <th>Ist layer</th> <th>IIInd layer</th> <th>IIIrd layer</th> <th>IVth layer</th> </tr> </thead> <tbody> <tr><td>80</td><td>40</td><td>40</td><td>--</td><td>--</td></tr> <tr><td>100</td><td>50</td><td>50</td><td>--</td><td>--</td></tr> <tr><td>110</td><td>65</td><td>50</td><td>--</td><td>--</td></tr> <tr><td>120</td><td>75</td><td>50</td><td>--</td><td>--</td></tr> <tr><td>130</td><td>65</td><td>40</td><td>25</td><td>--</td></tr> <tr><td>140</td><td>75</td><td>65</td><td>--</td><td>--</td></tr> <tr><td>150</td><td>75</td><td>75</td><td>--</td><td>--</td></tr> <tr><td>200</td><td>75</td><td>75</td><td>50</td><td>--</td></tr> </tbody> </table> |                                                                 |              | Thickness of insulation(mm) | Ist layer | IIInd layer | IIIrd layer | IVth layer | 80 | 40 | 40 | -- | -- | 100 | 50 | 50 | -- | -- | 110 | 65 | 50 | -- | -- | 120 | 75 | 50 | -- | -- | 130 | 65 | 40 | 25 | -- | 140 | 75 | 65 | -- | -- | 150 | 75 | 75 | -- | -- | 200 | 75 | 75 | 50 | -- |
| Thickness of insulation(mm)                                                                                                                                                                                                   | Ist layer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | IIInd layer | IIIrd layer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | IVth layer                                                      |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| 80                                                                                                                                                                                                                            | 40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 40          | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | --                                                              |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| 100                                                                                                                                                                                                                           | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 50          | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | --                                                              |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| 110                                                                                                                                                                                                                           | 65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 50          | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | --                                                              |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| 120                                                                                                                                                                                                                           | 75                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 50          | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | --                                                              |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| 130                                                                                                                                                                                                                           | 65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 40          | 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | --                                                              |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| 140                                                                                                                                                                                                                           | 75                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 65          | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | --                                                              |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| 150                                                                                                                                                                                                                           | 75                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 75          | --                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | --                                                              |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| 200                                                                                                                                                                                                                           | 75                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 75          | 50                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | --                                                              |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| INVENTORY No.                                                                                                                                                                                                                 | <p>**If the mattress thickness combination are indicated in the insulation schedule, the above instruction is to be ignored. The necessary guide lines of fixing arrangement for pipe section &amp; mattresses are given in the drawings at sheet nos 10 &amp; 11.</p> <p>h) Insulation Fixing Arrangements:-<br/>Typical fixing arrangements for insulation of pipes &amp; pipe fittings are shown vide drawings listed below;</p> <p>i) Fixing arrangement pipe section and lightly bonded mattresses/ mattresses at sheet nos. 10, 12 &amp; 13.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                 |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| REV. No.                                                                                                                                                                                                                      | <p>WORKED BY: - <i>Rigam</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                 |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |
| 04                                                                                                                                                                                                                            | <p>CHECKED BY: - <i>humb</i></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                 |              |                             |           |             |             |            |    |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |     |    |    |    |    |

|                            |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                           |  |              |
|----------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|--|--------------|
| SIGN & DATE                |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | PRODUCT STANDARD          |  | ST 29005     |
|                            |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | STEAM TURBINE ENGINEERING |  | PAGE 8 OF 23 |
| SUPERSEDES INVENTORY No.   |          | ii) Fixing arrangements for lightly bonded mattress at sheet nos 11,12 & 13.<br>iii) Lugs at sheet no 14.<br>iv) Flats at sheet no. 15.<br>v) Fixing of insulation on valves at sheet no. 16.<br>vi) Insulation of tee at sheet no. 17.<br>vii) Insulation of elbow at sheet no. 18.<br>viii) Pipe clamp carbon steel at sheet no. 19.<br>ix) Pipe clamp alloy steel at sheet no. 20.                                                                                                                                                                                                                                                                                                           |                           |  |              |
| COPYRIGHT AND CONFIDENTIAL |          | The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                           |  |              |
| SIGN & DATE                |          | 8.0 PROTECTION OF MATERIALS DURING STORAGE<br><br>The supplier shall protect the insulation materials from weather at all times from delivery to finish. Decking & covering tarpaulins alone are not adequate for any length of time & shall not be allowed except in extreme emergencies and only for short periods. Stacking of insulating materials directly on ground shall not be done.                                                                                                                                                                                                                                                                                                    |                           |  |              |
| SIGN & DATE                |          | 9.0 GUARANTEES<br><br>The supplier shall guarantee that if the specified maximum surface temperatures are exceeded on actual measurement, the supplier shall either replace the insulation with a superior material or provide additional insulation thickness at the BHEL'S/ site engineers discretion at no extra cost to the BHEL.<br>The supplier shall also guarantee the quality of the materials used & workmanship for a period of 18 months from the date of commissioning. Any defects arising from faulty materials or workmanship during this period shall be rectified by the supplier at no extra cost to BHEL.                                                                   |                           |  |              |
| SIGN & DATE                |          | 10.0 INSPECTION & TESTING<br><br>10.1 Thermal insulating material :-<br><br>Supplier shall arrange for carrying out all the tests for establishing thermal conductivity values, physical & chemical properties as required by relevant IS & or BS codes and standards. The tests shall be done on representative samples drawn from each lot of insulation material to be supplied under this specification & prior intimation shall be given so that BHEL can depute their representative to witness any or all the tests. For thermal conductivity values, test certificates from independent authorized testing agency (subject to BHEL'S approval) shall be furnished to BHEL for approval. |                           |  |              |
| SIGN & DATE                |          | 10.2 Other materials :-<br><br>For other materials i.e. cladding sheet, wire netting, binding wires, stitching & lacing wires etc., manufacturers correlated test certificates as per relevant codes & standards shall be furnished. In case correlating test certificates are not available, the supplier shall arrange to carry out necessary tests in presence of BHEL'S representative.                                                                                                                                                                                                                                                                                                     |                           |  |              |
| INVENTORY No.              | REV. NO. | WORKED BY: - <i>Rigam</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                           |  |              |
| P- 5768                    | 04       | CHECKED BY: - <i>Shinde</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                           |  |              |



|                                                                                                                                                                                                                                               |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                          |                           |                                                 |                                                                                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|---------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------|
| दिनांक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                                           |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | उत्पाद मानक<br><br><b>STEAM TURBINE ENGINEERING<br/>PRODUCT STANDARD</b> |                           | <b>ST29005</b><br>पृष्ठ 23 का 9<br>Page 9 of 23 |                                                                                                |
| शीर्षक सूची संख्या को<br>अधिकृतित करता है                                                                                                                                                                                                     | SUPERSEDES<br>INVENTORY NO.                                                         | <p>All test certificates shall be furnished &amp; written approval shall be taken from BHEL before commencement of the supply of material.</p> <p><b>11.0 DOCUMENTS TO BE SUBMITTED</b></p> <p>Two copies of the following pre-approval documents shall be submitted by the bidder along with the offer :-</p> <ul style="list-style-type: none"> <li>(i) Thermal conductivity values of the insulating materials at various mean temperatures not older than 2 years for densities 100, 120 &amp; 150 Kg / m<sup>3</sup> from government approved lab for information.</li> <li>(ii) Manufacturer's descriptive and illustrative literature for insulating materials offered with complete properties as per relevant standards.</li> <li>(iii) Quality plan duly signed on BHEL format for approval.</li> <li>(iv) Total bill of material of each item, giving the material specification, density / size / thickness, quantity and the wastage allowance considered shall be indicated in Data Sheet / Insulation schedule, alongwith its thickness calculation.</li> </ul> |                                                                          |                           |                                                 |                                                                                                |
| <p><b>COPYRIGHT AND CONFIDENTIAL.</b><br/>         The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company.</p> |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                          |                           |                                                 |                                                                                                |
| <p><b>स्वत्वाधिकार एवं गोपनीय</b><br/>         इस दस्तावेज में दी गई सूचना भारत भारी इलेक्ट्रिकल्स की सम्पत्ति है इसका प्रत्यक्ष एवं अप्रत्यक्ष रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए ।</p>                |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                          |                           |                                                 |                                                                                                |
| दिनांक<br>SIGN & DATE                                                                                                                                                                                                                         |  | 11/12/05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                          |                           |                                                 |                                                                                                |
| शीर्षक सूची संख्या<br>INVENTORY NO.                                                                                                                                                                                                           | P-5788                                                                              | REV. NO.<br><br>04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                          | निर्माणकर्ता<br>WORKED BY | S.K.G.                                          |  4/2/05   |
|                                                                                                                                                                                                                                               |                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                          | जांचकर्ता<br>CHECKED BY   | V.K.G.                                          |  04.02.05 |

|                                |                               |                                                                                                                                                                                                                       |                             |             |
|--------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------|
| INVENTORY No.<br><b>P-5788</b> | SIGN & DATE<br><b>22/6/87</b> | COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company. | SUPERSEDES<br>INVENTORY No. | SIGN & DATE |
| REV. NO<br><b>04</b>           |                               |                                                                                                                                                                                                                       |                             |             |
|                                |                               | <b>PRODUCT STANDARD</b><br><b>STEAM TURBINE ENGINEERING</b>                                                                                                                                                           |                             |             |
|                                |                               | <b>ST 29005</b><br><b>PAGE 10 OF 23</b>                                                                                                                                                                               |                             |             |

INSULATION SUPPORT

SPIDER (VERTICAL PIPING ONLY)

GI BAND 30X0.71

SECURED TIGHTLY ON FINAL LAYER AS PER DETAIL-A AND FASTENED WITH TWO NOS OF SELF TAPPING SCREWS

SELF TAPPING SCREWS  
2 Nos.

FLAT 3-15 THK FOR C.S. AND 6 THK FOR A.S. AS SPACED AS PER DETAIL-B

CLAMPS (A.S. OR C.S.) DEPENDING ON PIPE MATERIAL

BOLT & NUT FOR C.S. CLAMPS STUD & NUT FOR A.S. CLAMPS

ALU. STRAP/G.I. REAR END

ALU. STRAP

DETAIL A

DETAIL B

RIVET

ASBESTOS MILL BOARD

LUGS (C.S. OR A.S.) DEPENDING ON PIPE MAT.

ALU. SHEET 40X

FOR HORIZONTAL PIPES (FOR FIRST LAYER PIPE SECTION AND SUBSEQUENT LAYERS LIGHTLY BONDED SLAB) R MATTERSES)

WORKED BY: - *Rigam*CHECKED BY: - *Shinder*



|                                                                                   |                        |                                                                                                                                                                                                                       |                                                             |             |
|-----------------------------------------------------------------------------------|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|-------------|
| INVENTORY No.<br>P-5788                                                           | SIGN & DATE<br>22/4/89 | COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company. | SUPERSEDES<br>INVENTORY No.                                 | SIGN & DATE |
|  |                        |                                                                                                                                                                                                                       | <b>PRODUCT STANDARD</b><br><b>STEAM TURBINE ENGINEERING</b> |             |
| <b>ST 29005</b>                                                                   |                        |                                                                                                                                                                                                                       | <b>PAGE 11 OF 23</b>                                        |             |

SECTION - BB  
FOR VERTICAL PIPES WITH  
INSULATION THICKNESS 161MM AND ABOVE

REV. NO.  
D4

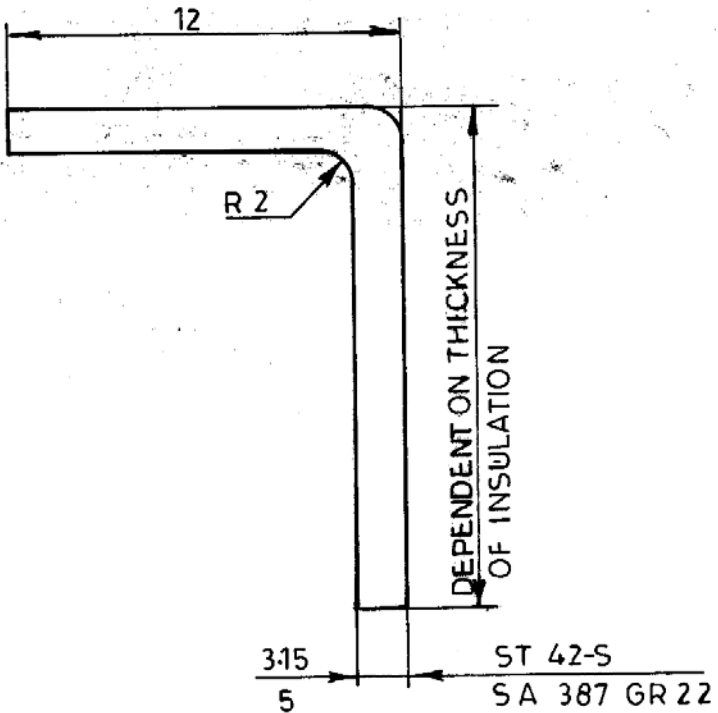
WORKED BY: — *Rigan*

CHECKED BY: — *Shinde*

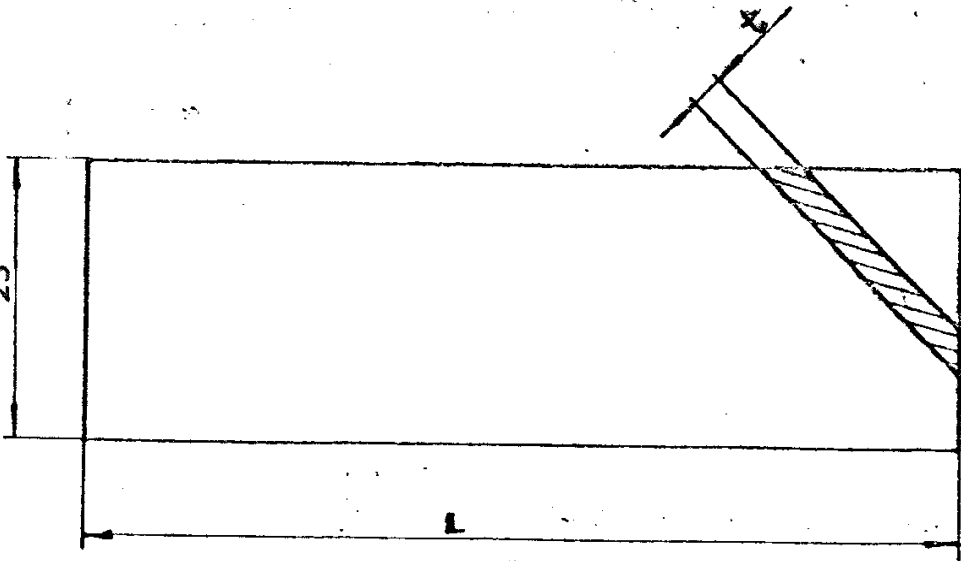
|                                                                                                                                                                                         |                                    |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                   |                             |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------|-----------------------------|
| SIGN & DATE<br><br>SUPERSEDES<br>INVENTORY No.                                                                                                                                          |                                    |  | <b>PRODUCT STANDARD</b><br><br><b>STEAM TURBINE ENGINEERING</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                   | FORM<br><br><b>ST 29005</b> |
|                                                                                                                                                                                         |                                    |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                   | PAGE 12 OF 23               |
|                                                                                                                                                                                         |                                    |                                                                                   | <p><b>NOTES ON ERECTION :-</b></p> <p><b>A. (ONLY PIPE SECTION)</b></p> <ol style="list-style-type: none"> <li>1. Fix support spider on vertical pipes. Bottom most spider at tangent point of bend/tee.</li> <li>2. Commence insulation of all layers except last layers of insulation, from support spider level in vertical pipes.</li> <li>3. Fit each layer of insulation and secure with 30 x 0.71 GI bands at spacing as shown. Secure it tightly by cutting the alu. sheet as per detail-A.</li> <li>4. Secure last layer of insulation and fasten it at a GI band 30 x 0.71 (as detail-A).</li> <li>5. Fix cladding sheet and apply sealant.</li> <li>6. For horizontal pipes use GI bands 30 x 0.71 and secure it as per detail-A.</li> </ol> <p><b>B. FIRST LAYER PIPE SECTION AND SUBSEQUENT LAYERS LRB</b></p> <p style="text-align: center;"><b>MATTRESSES OR MATTRESSES.</b></p> <ol style="list-style-type: none"> <li>1. For horizontal pipes secure tightly the first layer of pipe section using 30 x 0.71 GI bands and as per detail-A.</li> <li>2. Insert lugs for horizontal pipes and secure it tightly using alu. sheet 40 x 1 as per detail-A.</li> <li>3. Fit in asbestos mill board and rivet.</li> <li>4. Insert the LRB mattresses or mattresses with field cut slots from edge in felt and wire netting to clear lugs.</li> <li>5. Fix cladding sheet and apply sealant.</li> <li>6. For fixing of insulation in vertical pipes follow the same as the one for pipe section.</li> </ol> <p><b>C. GENERAL</b></p> <ol style="list-style-type: none"> <li>a) After proper folding (as per detail-A) the ends are to be properly fastened by using two nos. self tapping screws per band.</li> <li>b) Lugs/flats are issued in standard length running meters. They are to be cut at site depending on insulation thickness.</li> </ol> <p><b>D. NOTES ON APPLICATION</b></p> <ol style="list-style-type: none"> <li>1. Fix insulation support spiders on vertical pipes. Bottom most spider at tangent point of bend/tee at bottom.</li> <li>2. Fix cladding support spacer ring at specified intervals by using aluminium strap tightly (as per detail-A).</li> <li>3. Commence insulation on all layers of insulation except last layer from support spider level in vertical pipes.</li> <li>4. Insert insulation at support spacer rings locations with field cut slots from edge in felt and wire netting to clean lugs/projection.</li> <li>5. Stitch wire netting together at all edges and field cuts.</li> </ol> |                                                                   |                             |
| The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company. |                                    |                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                   |                             |
| INVENTORY No.<br><br><b>P-5788</b>                                                                                                                                                      | SIGN & DATE<br><br><b>2nd 6/89</b> | REV. NO.<br><br><b>04</b>                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | WORKED BY: - <i>Rigam</i><br><br>CHECKED BY: - <i>[Signature]</i> |                             |

| चिह्नक एवं हस्ताक्षर<br>SIGN & DATE                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>उत्पाद मानक</b><br><br><b>STEAM TURBINE ENGINEERING<br/>PRODUCT STANDARD</b> | <b>ST29005</b>                  |        |                    |        |          |   |            |   |           |   |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|---------------------------------|--------|--------------------|--------|----------|---|------------|---|-----------|---|
|                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                 | पृष्ठ 23 का 13<br>Page 13 of 23 |        |                    |        |          |   |            |   |           |   |
| सामग्री सूची संख्या को<br>INVENTORY NO.                                                                                                                                                                              | 6. Adjacent layers of insulation to be disposed to result in 50 mm overlap.<br>7. Fit last layer of insulation.<br>8. All gaps in insulation to be filled with cuttings & finished.<br>9. Provide and fix cladding with sealing compound.<br>10. Lugs and flats are issued for standard height. It has to be cut at site depending on insulation thickness ( refer insulation schedule for the thickness of insulation ).<br>11. This is applicable for LRB mattresses or mattresses ( both for horizontal and vertical piping ). |                                                                                 |                                 |        |                    |        |          |   |            |   |           |   |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of Bharat Heavy Electrical Limited. It must not be used directly or indirectly in any way detrimental to the interest of the company. | <b>DETAIL-B</b><br><br><table border="1"> <thead> <tr> <th>OUTER DIA. OF PIPE</th> <th>NO.OFF</th> </tr> </thead> <tbody> <tr> <td>Upto 219</td> <td>4</td> </tr> <tr> <td>273 to 406</td> <td>6</td> </tr> <tr> <td>Above 406</td> <td>8</td> </tr> </tbody> </table>                                                                                                                                                                                                                                                            |                                                                                 |                                 |        | OUTER DIA. OF PIPE | NO.OFF | Upto 219 | 4 | 273 to 406 | 6 | Above 406 | 8 |
| OUTER DIA. OF PIPE                                                                                                                                                                                                   | NO.OFF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                 |                                 |        |                    |        |          |   |            |   |           |   |
| Upto 219                                                                                                                                                                                                             | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                 |                                 |        |                    |        |          |   |            |   |           |   |
| 273 to 406                                                                                                                                                                                                           | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                 |                                 |        |                    |        |          |   |            |   |           |   |
| Above 406                                                                                                                                                                                                            | 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                 |                                 |        |                    |        |          |   |            |   |           |   |
| स्वत्वाधिकार एवं गोपनीय<br>इस दस्तावेज में की गई सूचना भारत हेवी इलेक्ट्रिकल्स की संपत्ति है इसका प्रयोग एवं अपरयोग रूप से किसी भी तरह प्रयोग, जो कि कंपनी के हित में हानिकारक हो न किया जाए।                        | E. Inspection at site during and after application of insulation shall be carried out as stipulated in the enclosed field quality plan.<br><br>F. <b>CROSS REFERRED STANDARDS :-</b><br><br>IS:737<br>IS:8183<br>IS:9842<br>IS:14164                                                                                                                                                                                                                                                                                              |                                                                                 |                                 |        |                    |        |          |   |            |   |           |   |
| हस्ताक्षर एवं चिह्नक<br>SIGN & DATE<br>14.8.04                                                                                                                                                                       | REV. NO.<br>04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                 |                                 |        |                    |        |          |   |            |   |           |   |
| सामग्री सूची संख्या<br>INVENTORY NO.<br>P-5788                                                                                                                                                                       | निर्माणकर्ता<br>WORKED BY<br>S.K.G.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                 | 7/7/04                          |        |                    |        |          |   |            |   |           |   |
|                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | जांचकर्ता<br>CHECKED BY<br>V.K.G.                                               |                                 | 7.7.04 |                    |        |          |   |            |   |           |   |



|                                                                                                                                                                                                                       |             |                                                                                   |                                                                                     |  |                      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--|----------------------|
| SIGN & DATE                                                                                                                                                                                                           |             |  | <b>PRODUCT STANDARD</b><br><b>STEAM TURBINE ENGINEERING</b>                         |  | <b>ST 29005</b>      |
|                                                                                                                                                                                                                       |             |                                                                                   |                                                                                     |  | <b>PAGE 14 OF 23</b> |
| SUPERSEDES                                                                                                                                                                                                            |             | INVENTORY No.                                                                     |  |  |                      |
| INVENTORY No.                                                                                                                                                                                                         |             |                                                                                   |                                                                                     |  |                      |
| COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company. |             |                                                                                   |                                                                                     |  |                      |
| INVENTORY No.                                                                                                                                                                                                         | SIGN & DATE |                                                                                   |                                                                                     |  |                      |
| P-5788                                                                                                                                                                                                                | 22/6/89     |                                                                                   |                                                                                     |  |                      |
| REV. NO. 04                                                                                                                                                                                                           |             | WORKED BY: — <i>Rigam</i>                                                         |                                                                                     |  |                      |
|                                                                                                                                                                                                                       |             | CHECKED BY: — <i>Shinde</i>                                                       |                                                                                     |  |                      |

LUGS

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |                                                                                                                                                                                                                          |                          |                |                                         |                            |    |                |            |             |   |  |  |    |                  |         |  |   |  |  |             |             |     |           |     |      |         |  |  |  |           |  |  |      |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|----------------|-----------------------------------------|----------------------------|----|----------------|------------|-------------|---|--|--|----|------------------|---------|--|---|--|--|-------------|-------------|-----|-----------|-----|------|---------|--|--|--|-----------|--|--|------|
| SIGN & DATE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | SIGN & DATE      | INVENTORY No.<br>P. 5788                                                                                                                                                                                                 | INVENTORY No.<br>22/6/88 | REV. NO.<br>04 | WORKED BY:- <i>Rigam</i>                | CHECKED BY:- <i>Shinde</i> |    |                |            |             |   |  |  |    |                  |         |  |   |  |  |             |             |     |           |     |      |         |  |  |  |           |  |  |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  | <b>PRODUCT STANDARD</b><br><b>STEAM TURBINE ENGINEERING</b>                                                                                                                                                              |                          |                | <b>ST 29005</b><br><b>PAGE 15 OF 23</b> |                            |    |                |            |             |   |  |  |    |                  |         |  |   |  |  |             |             |     |           |     |      |         |  |  |  |           |  |  |      |
| SUPERSEDES<br>INVENTORY No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  | COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.<br>It must not be used directly or indirectly in any way detrimental to the interest of the company. |                          |                |                                         |                            |    |                |            |             |   |  |  |    |                  |         |  |   |  |  |             |             |     |           |     |      |         |  |  |  |           |  |  |      |
| 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                  |                                                                                                                                        |                          |                |                                         |                            |    |                |            |             |   |  |  |    |                  |         |  |   |  |  |             |             |     |           |     |      |         |  |  |  |           |  |  |      |
| <b>NOTE:-</b><br>1. 'L' = 0.7 x INSULATION THICKNESS<br>2. 't' = 3.15 THK FOR CARBON STEEL (VAR. 01)<br>5 THK FOR ALLOY STEEL (VAR. 02)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |                                                                                                                                                                                                                          |                          |                |                                         |                            |    |                |            |             |   |  |  |    |                  |         |  |   |  |  |             |             |     |           |     |      |         |  |  |  |           |  |  |      |
| <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 10%;">02</td> <td style="width: 40%;">PLATE-3mm Thk.</td> <td style="width: 15%;">IS 942 255</td> <td style="width: 10%;">SA 387 GR22</td> <td style="width: 10%;">1</td> <td style="width: 10%;"></td> <td style="width: 5%;"></td> </tr> <tr> <td>01</td> <td>PLATE-3/15mm-Thk</td> <td>ST A2-S</td> <td></td> <td>1</td> <td></td> <td></td> </tr> <tr> <td>VARIANT No.</td> <td>DESCRIPTION</td> <td>STD</td> <td>MATL CODE</td> <td>A/C</td> <td>UNIT</td> <td>UNIT WT</td> </tr> <tr> <td></td> <td></td> <td></td> <td>MATL SPEC</td> <td></td> <td></td> <td>QTY.</td> </tr> </table> |                  |                                                                                                                                                                                                                          |                          |                |                                         |                            | 02 | PLATE-3mm Thk. | IS 942 255 | SA 387 GR22 | 1 |  |  | 01 | PLATE-3/15mm-Thk | ST A2-S |  | 1 |  |  | VARIANT No. | DESCRIPTION | STD | MATL CODE | A/C | UNIT | UNIT WT |  |  |  | MATL SPEC |  |  | QTY. |
| 02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | PLATE-3mm Thk.   | IS 942 255                                                                                                                                                                                                               | SA 387 GR22              | 1              |                                         |                            |    |                |            |             |   |  |  |    |                  |         |  |   |  |  |             |             |     |           |     |      |         |  |  |  |           |  |  |      |
| 01                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | PLATE-3/15mm-Thk | ST A2-S                                                                                                                                                                                                                  |                          | 1              |                                         |                            |    |                |            |             |   |  |  |    |                  |         |  |   |  |  |             |             |     |           |     |      |         |  |  |  |           |  |  |      |
| VARIANT No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | DESCRIPTION      | STD                                                                                                                                                                                                                      | MATL CODE                | A/C            | UNIT                                    | UNIT WT                    |    |                |            |             |   |  |  |    |                  |         |  |   |  |  |             |             |     |           |     |      |         |  |  |  |           |  |  |      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |                                                                                                                                                                                                                          | MATL SPEC                |                |                                         | QTY.                       |    |                |            |             |   |  |  |    |                  |         |  |   |  |  |             |             |     |           |     |      |         |  |  |  |           |  |  |      |
| <u>FLAT</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |                                                                                                                                                                                                                          |                          |                |                                         |                            |    |                |            |             |   |  |  |    |                  |         |  |   |  |  |             |             |     |           |     |      |         |  |  |  |           |  |  |      |

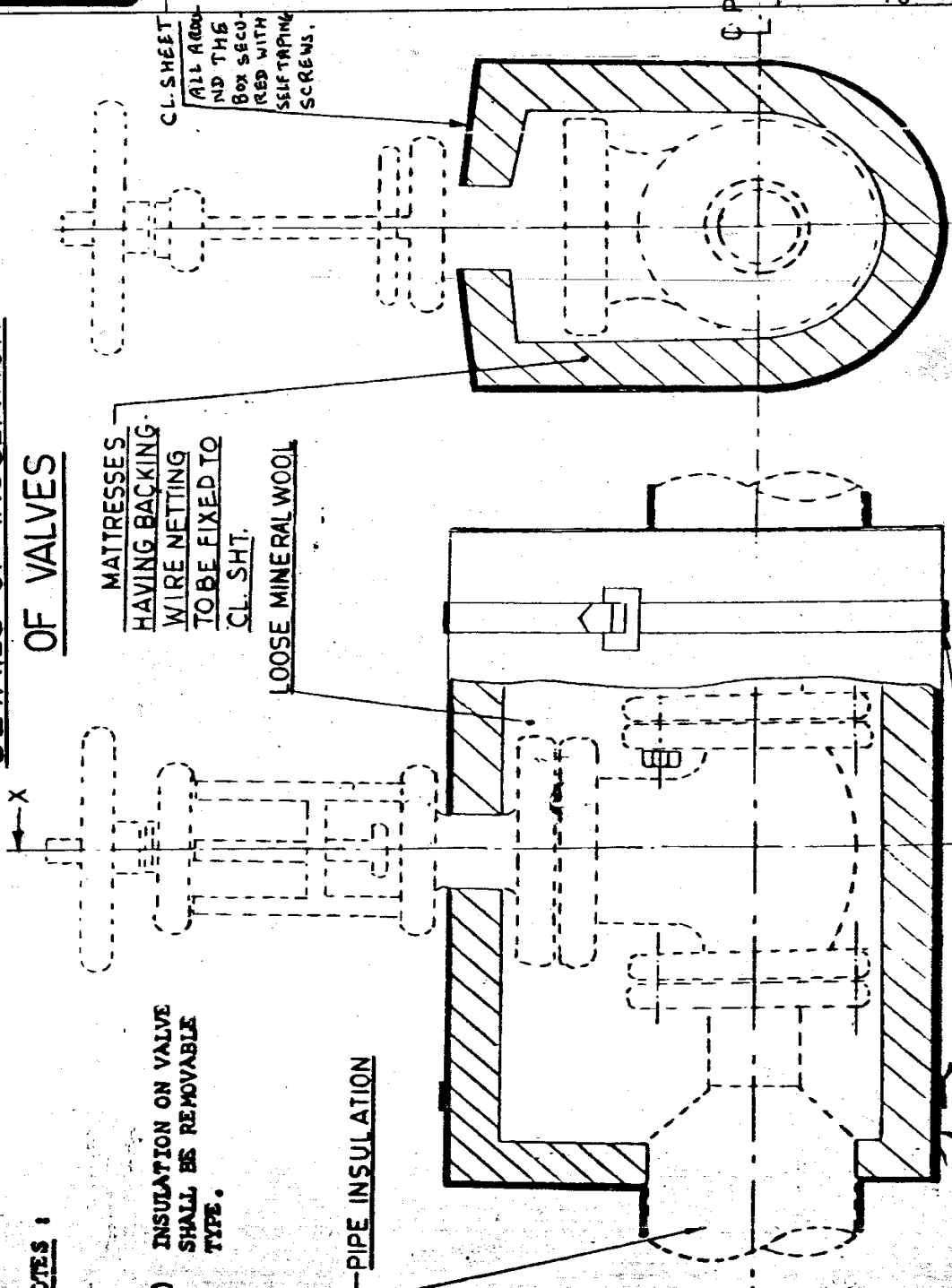
|                                |                               |                                                                                                                                                                                                                       |                             |             |
|--------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------|
| INVENTORY No.<br><b>P-5788</b> | SIGN & DATE<br><b>22/6/89</b> | COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company. | SUPERSEDES<br>INVENTORY No. | SIGN & DATE |
|--------------------------------|-------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------|



**PRODUCT STANDARD**  
**STEAM TURBINE ENGINEERING**

FORM  
**ST 29005**  
 PAGE 16 OF 23

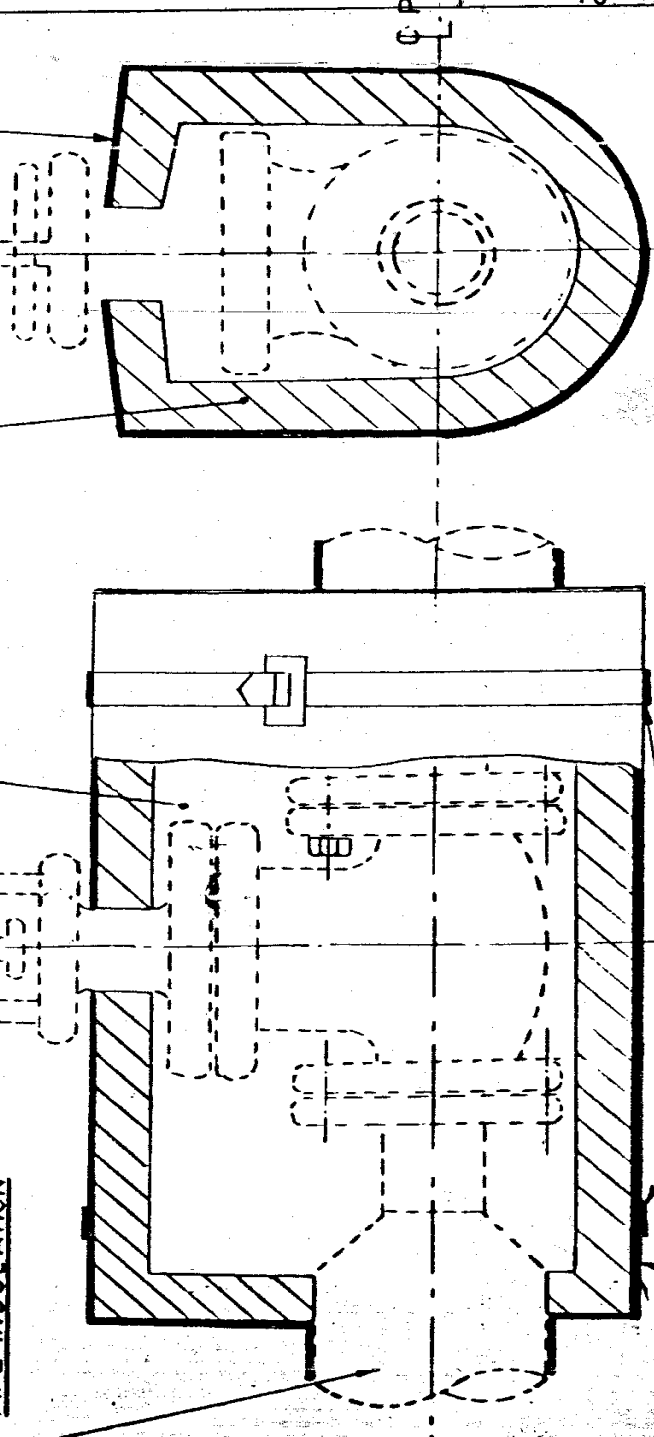
**DETAILS OF INSULATION OF VALVES**



**NOTES :**

1) INSULATION ON VALVE SHALL BE REMOVABLE TYPE.

**PIPE INSULATION**



**CL. SHEET**  
ALL ABOVE AND THE BOX SECURED WITH SELF TAPPING SCREWS.

**MATTRESSES HAVING BACKING WIRE NETTING TO BE FIXED TO CL. SHT.**

**LOOSE MINERAL WOOL**

**CL. SHEET**  
STRAPS MADE FROM CL. SHEET

**SEC. X-X**

WORKED BY: *Riga*

CHECKED BY: *[Signature]*



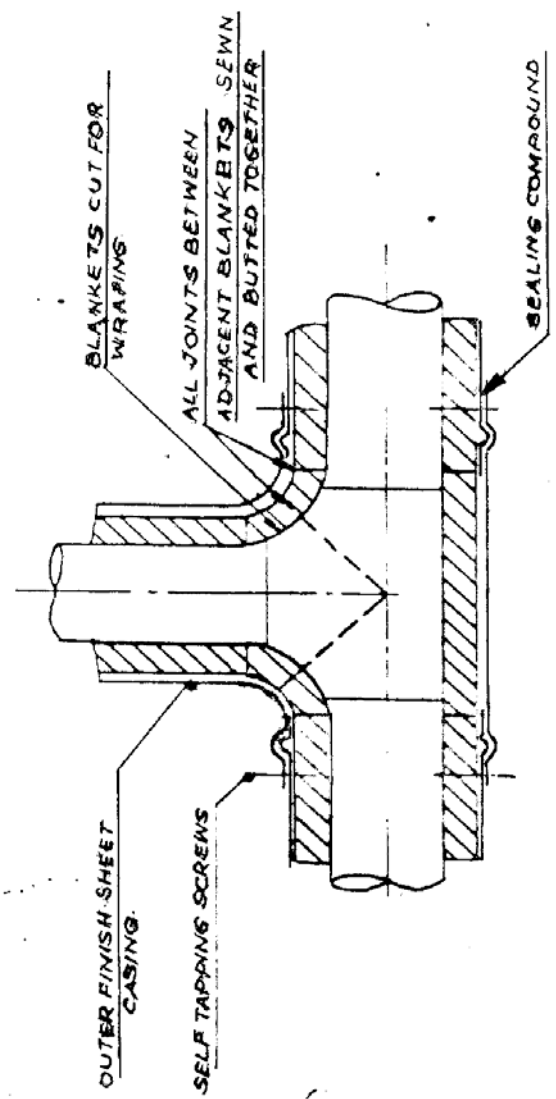
|               |             |                                                                                                                                                                                                                          |                             |             |
|---------------|-------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|-------------|
| INVENTORY No. | SIGN & DATE | COPYRIGHT AND CONFIDENTIAL<br>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.<br>It must not be used directly or indirectly in any way detrimental to the interest of the company. | SUPERSEDES<br>INVENTORY No. | SIGN & DATE |
| P-5788        | 22/6/89     |                                                                                                                                                                                                                          |                             |             |



**PRODUCT STANDARD**  
**STEAM TURBINE ENGINEERING**

|               |
|---------------|
| FORM          |
| ST 29005      |
| PAGE 17 OF 23 |

**FIXING OF INSULATION ON TEES**



**TEE INSULATION**  
**(WITH MATTRESS INSULATION)**

WORKED BY:- *Rigam*

CHECKED BY:- *Khund*

|          |
|----------|
| REV. NO. |
| 04       |

|               |             |
|---------------|-------------|
| INVENTORY No. | SIGN & DATE |
| P-5708        | 22-11-09    |

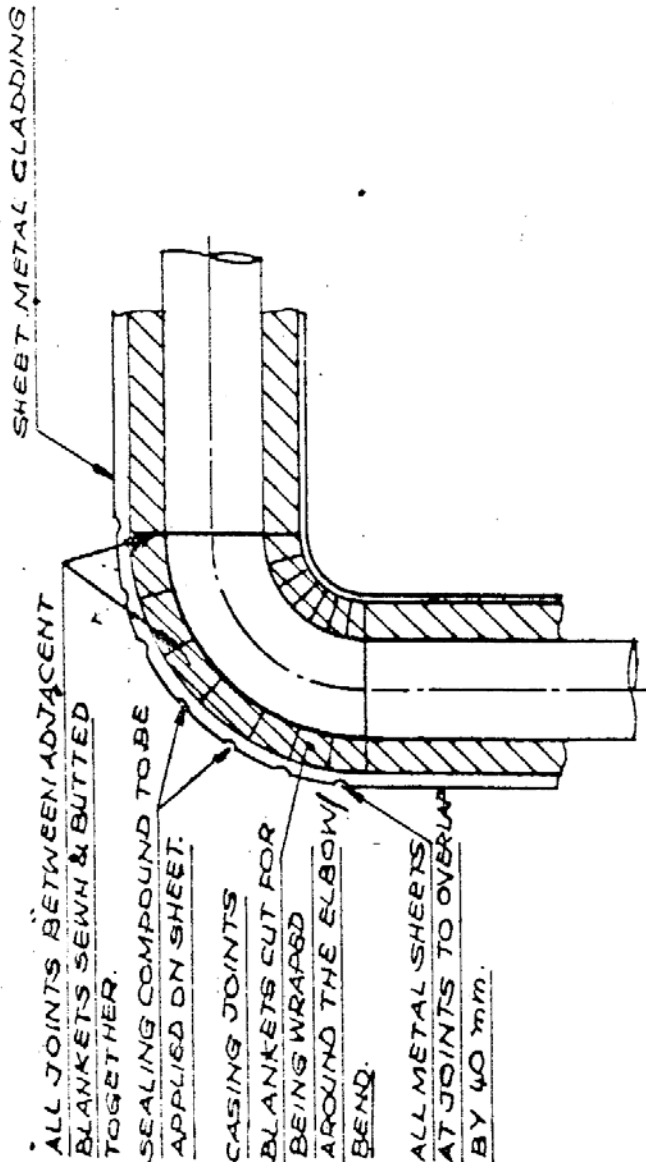
COPYRIGHT AND CONFIDENTIAL  
The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.  
It must not be used directly or indirectly in any way detrimental to the interest of the company.



PRODUCT STANDARD  
STEAM TURBINE ENGINEERING

|               |
|---------------|
| FORM          |
| ST 29005      |
| PAGE 18 OF 23 |

FIXING OF INSULATION  
ON BENDS / ELBOWS



WITH MATTRESS

REV.  
20.  
04

WORKED BY:- Riga

CHECKED BY:- [Signature]

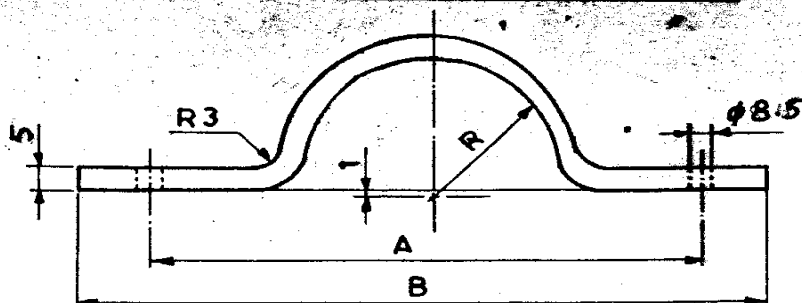
# PRODUCT STANDARD

## STEAM TURBINE ENGINEERING

**ST 29005**

**PAGE 19 OF 23**

### PIPE CLAMPS (CARBON STEEL)

[illegible]

**COPYRIGHT AND CONFIDENTIAL**

The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED. It must not be used directly or indirectly in any way detrimental to the interest of the company.

**SIGN & DATE**

INVENTORY NO.

2264

P-5788

REV.  
NO.  
04

WORKED BY:— Rizal

CHECKED By: Shind



INVENTORY NO.



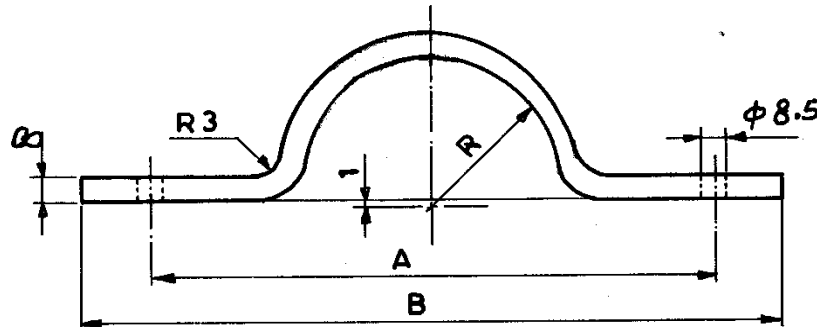
# PRODUCT STANDARD

## STEAM TURBINE ENGINEERING

ST 29005

**PAGE 20 OF 23**

PIPE CLAMPS (ALLOY STEEL)



| VAR. | A   | B   | R   | NB  | DESCRIPTION     | MATL.SPCN. | UNIT WT. |
|------|-----|-----|-----|-----|-----------------|------------|----------|
| 01   | 76  | 91  | 30  | 50  | PL. 8X50 X 125  | 13 Cr Mo44 | 0 400    |
| 02   | 88  | 103 | 37  | 65  | PL. 8X50X 150   | ↑          | 0 480    |
| 03   | 183 | 198 | 84  | 150 | PL. 8X50 X 295  |            | 0 920    |
| 04   | 234 | 249 | 110 | 200 | PL. 8X50X 380   |            | 1 200    |
| 05   | 288 | 303 | 137 | 250 | PL. 8X50X 460   |            | 1 450    |
| 06   | 371 | 306 | 178 | 350 | PL. 8X50 X 590  |            | 1 850    |
| 07   | 421 | 436 | 203 | 400 | PL. 8X50X 670   |            | 2 100    |
| 08   | 473 | 488 | 229 | 450 | PL. 8X50 X 752  |            | 2 400    |
| 09   | 523 | 538 | 254 | 500 | PL. 8X50 X 824  |            | 2 600    |
| 10   | 626 | 644 | 305 | 600 | PL. 8X50 X 990  |            | 3 000    |
| 11   | 123 | 138 | 54  | 100 | PL. 8X50 X 200  |            | 0 630    |
| 12   | 129 | 144 | 57  | 100 | PL. 8X50 X 210  |            | 0 660    |
| 13   | 174 | 189 | 80  | 150 | PL. 8X50 X 282  |            | 0 900    |
| 14   | 339 | 354 | 162 | 300 | PL. 8X50X 540   |            | 1 700    |
| 15   | 365 | 380 | 175 | 350 | PL. 8X50 X 580  |            | 1 820    |
| 16   | 569 | 584 | 280 | 550 | PL. 8X50X 910   |            | 2 860    |
| 17   | 104 | 119 | 44  | 80  | PL. 8X50X 166   |            | 0 520    |
| 18   | 156 | 171 | 70  | 125 | PL. 8X50 X 248  | ↓          | 0 78     |
| 19   | 730 | 745 | 356 | 700 | PL. 8X50 X 1150 | 13 Cr Mo44 | 3 310    |

REV.  
NO.  
04

WORKED BY:- Ruigan

CHECKED BY:- *[Signature]*





**PRODUCT STANDARD**  
**STEAM TURBINE ENGINEERING**

ST 29005

PAGE 22 OF 23

SIGN &amp; DATE

SUPERSEDES  
INVENTORY No.

COPYRIGHT AND CONFIDENTIAL

The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED.  
It must not be used directly or indirectly in any way detrimental to the interest of the company.

SIGN &amp; DATE

INVENTORY No.

22/6/89

P-5788

FIELD QUALITY PLAN :-

| SL NO | COMPONENT/ OPERATION | CHARACTERISTIC CHECKED                | CAT | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT  | ACCEPTANCE NORM     | FORMAT OF RECORD | REMARKS                                                           |
|-------|----------------------|---------------------------------------|-----|-----------------------|-----------------|---------------------|---------------------|------------------|-------------------------------------------------------------------|
| 02    | APPLICATION          | Surface cleanliness                   | MA  | Visual                | Random          | Specification       | Specification       | Log Sheet        | Surface shall be free from dirt, rust, scale, oil etc. and dried. |
|       |                      | Insulation material appearance.       | MA  | -do-                  | -do-            | -do-                | -do-                | -do-             | Material shall be uniform and free from cracks, voids etc.        |
|       |                      | Binding wires/ Bands spacing          | MA  | -do-                  | -do-            | Appd. drg & specif. | Appd. drg & specif. | -do-             |                                                                   |
|       |                      | Wire netting dimensions and location. | MA  | -do-                  | -do-            | -do-                | -do-                | -do-             |                                                                   |
|       |                      | Wire ends                             | MA  | -do-                  | -do-            | -do-                | -do-                | -do-             | Wire ends shall be twisted and bent inside.                       |
|       |                      | Supports arrangements & spacing       | MA  | -do-                  | -do-            | -do-                | -do-                | -do-             |                                                                   |
|       |                      | Expansion joints spacing.             | MA  | -do-                  | -do-            | -do-                | -do-                | -do-             |                                                                   |
|       |                      | Insulation thickness test             | MA  | Physical              | 10%             | IS 7413 & Specf.    | IS 7413 & Specf.    | -do-             |                                                                   |
|       |                      | Uniformity of thickness               | MA  | -do-                  | -do-            | -do-                | -do-                | -do-             |                                                                   |
|       |                      | Bulk density test                     | MA  | -do-                  | -do-            | -do-                | -do-                | -do-             |                                                                   |

Contd. on page 23

WORKED BY :- *Prigam*REV. NO.  
04CHECKED BY :- *[Signature]*





| MANUFACTURER'S NAME AND ADDRESS |                        |               |                 |   |       | STANDARD QUALITY PLAN |   |                  |        |                    |    |                  | TO BE FILLED BY BHEL |                   |    |        |   |         |    |  | TO BE FILLED BY BHEL |  |  |  |  |  |  |  |
|---------------------------------|------------------------|---------------|-----------------|---|-------|-----------------------|---|------------------|--------|--------------------|----|------------------|----------------------|-------------------|----|--------|---|---------|----|--|----------------------|--|--|--|--|--|--|--|
| BHEL                            |                        | VENDOR'S NAME |                 |   |       | ITEM                  |   |                  | QP NO. |                    |    |                  |                      |                   |    |        |   |         |    |  |                      |  |  |  |  |  |  |  |
|                                 |                        |               |                 |   |       |                       |   | DATED            |        |                    |    |                  |                      |                   |    |        |   |         |    |  |                      |  |  |  |  |  |  |  |
|                                 |                        |               |                 |   |       | DRG. NO.              |   |                  |        |                    |    |                  |                      |                   |    |        |   |         |    |  |                      |  |  |  |  |  |  |  |
|                                 |                        |               |                 |   |       | SPEC.                 |   |                  |        |                    |    |                  |                      |                   |    |        |   |         |    |  |                      |  |  |  |  |  |  |  |
|                                 |                        |               |                 |   |       | REV                   |   |                  |        | Page 1 of 3        |    |                  |                      |                   |    |        |   |         |    |  |                      |  |  |  |  |  |  |  |
| SL. NO.                         | COMPONENT & OPERATIONS |               | CHARACTERISTICS |   | CLASS | TYPE OF CHECK         |   | QUANTUM OF CHECK |        | REFERENCE DOCUMENT |    | ACCEPTANCE NORMS |                      | FORMAT OF RECORDS |    | AGENCY |   | REMARKS |    |  |                      |  |  |  |  |  |  |  |
| 1                               | 2                      | 3             | 4               | 5 | 6     | 7                     | 8 | 9                | 10     | 11                 | 12 | 13               | 14                   | 15                | 16 | M      | B | N       | 17 |  |                      |  |  |  |  |  |  |  |
| 1                               | 2                      | 3             | 4               | 5 | 6     | 7                     | 8 | 9                | 10     | 11                 | 12 | 13               | 14                   | 15                | 16 | M      | B | N       | 17 |  |                      |  |  |  |  |  |  |  |

[illegible]

|                            |  |  |                                                                                                                                                                                                                                                                                                                        |             |
|----------------------------|--|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|
|                            |  |  | FOR CUSTOMER USE                                                                                                                                                                                                                                                                                                       |             |
|                            |  |  | LEGEND:<br>! RECORDS IDENTIFIED WITH 'TICK' SHALL BE ESSENTIALLY INCLUDED BY CONTRACTOR IN QA DOCUMENTATION.<br>M: MANUFACTURER / SUBCONTRACTOR B: BHEL / NOM. INSPECTION AGENCY<br>N: CUSTOMER<br>INDICATE 'P' PERFORM 'W' WITNESS AND 'V' VERIFICATION<br>ALL 'W' INDICATED IN COLUMN 'N' SHALL BE 'CHP' OF CUSTOMER | APPROVED BY |
| MANUFACTURER/SUBCONTRACTOR |  |  |                                                                                                                                                                                                                                                                                                                        |             |

172