

3X200+3X500+1x500 MW NTPC KORBA TPP-FGD

| NTPC DOCUMENT NO. | DOCUMENT NAME | BHEL DOCUMENT NO. | |
|--|---|------------------------------|-------------------------|
| 2100-109-PVM-B-262 | TDS AND GA OF PAC / SPLIT AIR CONDITIONER | PE-V0-466-(571-13000-A)-A213 | |
| Technical Specifications | | | |
| Product Information | Product code | IA318DNU/ IA318DNUWK | IA324DNU/ IA324DNUWK |
| Performance Parameters | Product Series | DN | DN |
| | Norminal cooling capacity (TR) | 1.5 TR | 2.0 TR |
| | Air conditioner Type | Inverter split AC | Inverter split AC |
| | Star Rating - As Per bee | 3-Star | 3-Star |
| | Rated voltage/Frequency/Phase | 230 V/ 50Hz/Single | 230 V/ 50Hz/Single |
| | Rated cooling capacity (min-Max)(watt) | 5050(1415~5472) | 6350(1772~6624) |
| | Rated cooling capacity (min-Max) (BTU/HR) | 17230(4828~18670) | 21666(6046~2260) |
| | Rated cooling capacity (50% Load)(watt) | 2525 | 3175 |
| | Rated cooling capacity (min-Max)(watt) | 1590(355~1733) | 2025(404~2118) |
| | Cooling Power input (50% Load (watt) | 610 | 770 |
| | Iseer | 3.93 | 3.9 |
| | Electricity consumed in 1600 Hour (units/Year) | 995.24 | 1261.37 |
| | Norminal current (cooling in Amps) Runing current | 7.2 | 9.17 |
| | Air flow volume (wet CFM) (High/Medium/Low) | 514/450/415 | 576/501/399 |
| Compressor,Refrigerant & Ambient Operations | Noise level indoor (High/Medium/Low)in Db(A) | 48.5/45.5/39.1 | 46.8/43.7/37.7 |
| | Moisturer removal (Litre/Hour) | 1.2 | 2 |
| | Compressor type | Inverter Rotary | Inverter Rotary |
| | Refrigerant(Eco- Friendly) | R-32 | R-32 |
| | Ambient Temperature range (cooling)degree C | Up to 52degree C | Up to 52degree C |

| NTPC DOCUMENT NO. | DOCUMENT NAME | | BHEL DOCUMENT NO. |
|--|---|-------------------------|------------------------------|
| 2100-109-PVM-B-262 | TDS AND GA OF PAC / SPLIT AIR CONDITIONER | | PE-V0-466-(571-13000-A)-A213 |
| Product Information | Product code | IA318DNU/ IA318DNUWK | IA324DNU/ IA324DNUWK |
| User Interface - Remote | Remote | LCD Remote with display | LCD Remote with display |
| Product Dimension, weight & Input Power Supply | IDU net dimesion (w*H*D) mm | 960X320X215 | 1110X335X215 |
| | Input power supply | Indoor Unit | Indoor Unit |
| | Net weight IDU (In Kg) | 12 | 15 |
| | ODU net dimesion (w*H*D) mm | 858X536X327 | 888.4X581.5X367 |
| | Net weight ODU (In Kg) | 25 | 31.5 |
| | Noise level indoor in dB(A) | 60 | 60 |
| Tube Size & Piping Capcity | Suction tube size outer diameter inch (mm) | 1/2"(12.7mm) | 5/8"(15.88mm) |
| | Liquid tube size outer diameter inch (mm) | 1/4"(6.35mm) | 1/4"(6.35mm) |
| | Max piping capcity total (Metre) | 15 | 15 |
| | Max piping capcity vertical (Metre) | 10 | 10 |
| | Refrigerant additional charge beyond 5M (g/m) | 15 | 15 |



DNU SERIES



AVAILABLE IN 1 TR. 1.5 TR. 2.0 TR.

Smart-Ready

Energy Saver

Turbo Cool

Fix & Lock (4 in 1 Convertible Cooling)

Comfort Sleep

Stabiliser-Free Operation

Nano BluProtect Technology

100% Copper

Anti-Corrosive Blue Fins for Protection

*DNUWK - without kit models available in 1, 1.5, 2.0 TR



Technical Specifications

| Product Information | Product Code | IA312DNU/ IA312DNUWK | IA318DNU/ IA318DNUWK | IA324DNU/ IA324DNUWK |
|--|---|---|-------------------------|-------------------------|
| Performance Parameters | Product Series | DN | DN | DN |
| | Nominal Cooling Capacity (TR) | 1.0 TR | 1.5 TR | 2.0 TR |
| | Air Conditioner Type | Inverter Split AC | Inverter Split AC | Inverter Split AC |
| | Star Rating - As Per BEE | 3-Star | 3-Star | 3-Star |
| | Rated Voltage/Frequency/Phase | 230 V/50Hz/Single | 230 V/50Hz/Single | 230 V/50Hz/Single |
| | Rated Cooling Capacity (Min~Max) (Watt) | 3500 (1137~4013) | 5050 (1415~5472) | 6350 (1772~6624) |
| | Rated Cooling Capacity (Min~Max) (BTU/Hr) | 11942 (3880~13693) | 17230 (4828~18670) | 21666 (6046~22601) |
| | Rated Cooling Capacity (50% Load) (Watt) | 1750 | 2525 | 3175 |
| | Rated Cooling Power Input (Min~Max) (Watt) | 1163 (304 ~ 1306) | 1590 (355~1733) | 2025 (404~2118) |
| | Cooling Power Input (50% Load) (Watt) | 420 | 610 | 770 |
| | ISEER | 3.85 | 3.93 | 3.90 |
| | Electricity Consumed in 1600 Hours (Units/Year) | 704.42 | 995.24 | 1261.37 |
| | Compressor, Refrigerant & Ambient Operations | Nominal Current (Cooling in Amps)/Running Current | 4.51 | 7.2 |
| Air Flow Volume (Wet CFM) (High/Medium/Low) | | 368/315/234 | 514/450/415 | 576/501/399 |
| Noise Level Indoor (High/Medium/Low) In dB(A) | | 41/36.8/30.5 | 48.5/45.5/39.1 | 46.8/43.7/37.7 |
| Moisture Removal (Litres/Hour) | | 1.14 | 1.20 | 2.0 |
| Compressor Type | | Inverter Rotary | Inverter Rotary | Inverter Rotary |
| Compressor Warranty | | 10 Years | 10 Years | 10 Years |
| Acoustic Jacket on Compressor | | Yes | Yes | Yes |
| User Interface - Remote | Refrigerant (Eco-Friendly) | R-32 | R-32 | R-32 |
| | Ambient Temperature Range (Cooling) °C | Up to 52°C | Up to 52°C | Up to 52°C |
| Product Dimensions, Weight & Input Power Supply | Remote | LCD Remote with Display | LCD Remote with Display | LCD Remote with Display |
| | IDU Net Dimension (W * H * D) mm | 845 x 300 x 193 | 960 x 320 x 215 | 1110 x 335 x 215 |
| | Input Power Supply | Indoor Unit | Indoor Unit | Indoor Unit |
| | Net Weight IDU (in Kg) | 10 | 12 | 15 |
| | ODU Net Dimension (W * H * D) mm | 858 x 536 x 327 | 858 x 536 x 327 | 888.4 x 581.5 x 367 |
| | Net Weight ODU (in Kg) | 23.5 | 25 | 31.5 |
| Tube Size & Piping Capability | Noise Level Outdoor In dB(A) | 58 | 60 | 60 |
| | Suction Tube Size Outer Diameter Inch (mm) | 3/8" (9.53mm) | 1/2" (12.7mm) | 5/8" (15.88mm) |
| | Liquid Tube Size Outer Diameter Inch (mm) | 1/4" (6.35mm) | 1/4" (6.35mm) | 1/4" (6.35mm) |
| | Max Piping Capability Total (metre) | 15 | 15 | 15 |
| | Max Piping Capability Vertical (metre) | 10 | 10 | 10 |
| Refrigerant Additional Charge Beyond 5M (g/m) | 15 | 15 | 15 | |

As a continuing policy of research and development in Blue Star, the design, features, technical specifications are subject to change without prior notice. The product and remote images shown are for reference only and actual products may differ. Values mentioned are under standard tested conditions in lab. Actual performance values may vary with different ambient conditions. Features may vary from model to model.



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| | | | |
|----------------------|--|----------------|-------------------------|
| Customer | NTPC | Job No. | M22/DEL-015.BHEL |
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | Date | 11.12.2021 |
| BHEL Doc. No. | PE-V0-466-(571-13000-A)-A214 | ----- | |

| Details | | | | | | | | | |
|----------------|----------------------|-------------|--|--|--|--|------------------------------------|-------------------------|--|
| Sr.No | Description | Unit | Supply and return air duct for AC system | Refrigerant (Suction & Liquid Line) | AHU Drain pipe | AHU Condensate pan (Insulation if required) | Acoustic insulation of duct | Exposed air duct | |
| 1 | Surface | - | Armacell /A Flex | Armacell /A Flex | Armacell /A Flex | U.P.Twiga / Lloyd | U.P.Twiga / Lloyd | U.P.Twiga / Lloyd | |
| 2 | Make | - | Closed Cell Elastomeric Nitrile Rubber | Closed Cell Elastomeric Nitrile Rubber | Closed Cell Elastomeric Nitrile Rubber | Resin Bonded glass wool | Resin Bonded glass wool | Resin Bonded glass wool | |
| 3 | Material | - | ... | ... | ... | IS:8183 | IS:8183 | IS:8183 | |
| 4 | Standard to follow | - | Sheet | Tube | Tube | Slab | Slab | Roll | |
| 5 | Insulation form | - | 40-60 | 40-60 | 40-60 | 24 | 48 | 24 | |
| 6 | Density | kg/ m3 | 19 | 19 | 19 | 25 | 25 | 50 | |
| 7 | Thickness | mm | 0.036 at 20 °C | 0.036 at 20 °C | 0.036 at 20 °C | 0.049 at 50 °C | 0.043 at 50 °C | 0.049 at 50 °C | |
| 8 | Thermal Conductivity | w/m/deg C | As per manufacturer's standard | As per manufacturer's standard | As per manufacturer's standard | As per manufacturer's standard | Refer annexure-1) | F-4 (As per annexure-1) | |
| 9 | Finish | | | | | | | | |
| 10 | Application details | | Shall be as per approved Standard Drawing for Erection & Application Details of Insulation | | | | | | |

Note :
Insulation for HVAC application shall be CFC/HCFC free.

ANNEXURE-1

1) **Finish F-4 (with Resin Bonded Glass Wool/Resin Bonded Mineral Wool)**

Step-1 Wrapping of Poly-Bonded Hessain (PBH – to act as vapour seal) on outer surface of insulation with 50 mm overlap stitching and sealing of overlap with synthetic adhesive like CPRX or Equivalent compound.

Step-2 The surface then shall be wrapped with 19 mm mesh 24 SWG GI wire netting, butting all the joints and laced down with 22 SWG lacing wire.

Step-3 Sand cement (4:1) plaster shall be applied in two layers totalling to 12.5 mm thick, the second layer being brought to a smooth finish. A water proofing compound shall be added to the cement before its application.

Step-4 Application of 3 mm thick coat of suitable water proofing compound and wrapped with fibre glass RP tissue followed by final coat of 3 mm thick water proofing compound over the RP tissue.

ACCOUSTIC INSULATION

- a) All ducts up to a distance of 5 meters from AHU shall be acoustically lined from inside with 25 mm thick resin bonded glass wool of 48 Kg/Cu.M. density and 30 gauge perforated aluminium sheet having 5 mm dia perforation at 8 to 10 mm centre-to-centre distance.
- b) Fibre glass tissue sheet shall be applied over the outer surface of insulation before applying perforated aluminium sheet.

| | | | |
|----------------------|--|----------------|------------------------|
| Customer | NTPC | Job No. | M22/DEL-27.BHEL |
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | Date | 13.08.2021 |
| BHEL Doc. No. | PE-V0-466-(571-13000-A)-A215 | PACKAGE | HVAC FOR FGD |

TDS – GI SHEET

| Sr. No. | DESCRIPTION | SPECIFICATION |
|----------------|----------------------|--------------------------------------|
| 1 | Application | Low pressure air duct |
| 2 | Make | SAIL/TATA/JSW |
| 3 | Type | GI Sheet, Lock forming quality (LFQ) |
| 4 | Grade | Conforming to class 275 of IS : 277 |
| 5 | Form factors | Conforming to IS : 655 |
| 6 | Coating | 275 GSM |
| 7 | Shape | Rectangular |
| 8 | Flange type | TDF / TDC, as applicable |
| 9 | Gauge wise thickness | 0 to 750 mm - 24 G |
| | | 751 to 1500 mm - 22 G |
| | | 1501 to 2250 mm - 20 G |
| | | 2251 to above - 18 G |

Prep. By

Appr. By

Sh. 1 of 1

3X200+3X500+1x500 MW NTPC KORBA TPP-FGD**COMPLIANCE SHEET ON TECHNICAL DATA SHEET OF PIPE FOR AC & VENTILATION SYSTEM
2100-109-PVM-Y-005C**

| SI No. | NTPC COMMENTS ON R0 | BHEL / / REMARKS DT. 24.12.2021 | NTPC REPLY |
|--------|--|--|------------|
| 1 | Refrigerant Pipe: DELETE as it does not pertain to ventilation system. | <p>No separate document is available in MDL for Air Conditioning Pipes. We have updated the Title of the Document to cover Air Conditioning Line and formally requested NTPC to update the same in C Folder.</p> <p>There is no change in the document. Only Title of the document is corrected. Please approve.</p> | |

| | |
|-----------------|--|
| Name of Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD |
| Package | HVAC FOR FGD |
| Document Title | TECHNICAL DATASHEET OF PIPE FOR AC & VENTILATION SYSTEM |
| Document No. | NTPC:2100-109-PVM-Y-005C,BHEL:PE-V0-466-(571-13000-A)-A217 |
| | |

| Sl. No. | DESCRIPTION | SPECIFICATION | | |
|---------|-----------------|--|---|---------------------|
| 1 | Make | Jindal | | |
| 2 | Material | MS Black | | |
| 3 | Conforming To | <u>UAF Water Piping -</u> Heavy grade IS : 1239 up to 150 NB & IS 3589 beyond 200 NB | | |
| | | <u>Header & Drain/Overflow Pipe</u> Heavy grade IS : 1239 up to 150 NB & IS 3589 beyond 200 and galvanized as per IS 4736 | | |
| | | <u>Refrigerant Pipe</u> Seamless steel tubes conforming heavy grade IS:1239 or Copper tubes as per IS: 2501 (copper material as per IS: 191 hard copper grade) | | |
| | | <u>Fittings</u> 1) The steel Fitting shall conform to ASTM A234 Gr. WPB and Dimensional Standard to ANSI B 16.9/ANSI B 16.11 / equivalent for sizes 65 NB and above. 2) For sizes 50 NB and below, the material shall conform to ASTM A-105. 3) All Steel flanges shall be of slip on type and shall conform to ANSI B 16.5. 4) For pipe sizes above 350 NB, fabricated fittings from sheets of adequate thickness may be used. The bend Radius in case of mitre bends shall be minimum 1.5 times the Nominal Pipe diameter and angle between two adjacent sections shall not be more than 22.5 deg and shall be as per BS:2633/ BS:534. 5) Fittings, flanges and pipe joints of refrigerant piping shall conform to ANSI B 31.5. | | |
| | | | | |
| 4 | Thickness | Nominal Pipe (mm) | Outside Diameter (mm) | Wall Thickness (mm) |
| | | 200 NB | 219.1 | 4.5 |
| | | 250 NB | 273 | 5 |
| | | 300 NB | 323.9 | 5.6 |
| | | 350 NB | 355.6 | 5.6 |
| | | 400 NB | 406.4 | 6.3 |
| | | Below 150 NB | Refer attached document Heavy Grade as per IS: 1239 | |
| 5 | Density of pipe | 7850 Kg/m ³ | | |
| 6 | Pipe Sizes | As per approved P & ID | | |

| | |
|-----------------|---|
| Name of Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD |
| Package | HVAC FOR FGD |
| Document Title | TECHNICAL DATASHEET OF PIPE FOR AC & VENTILATION SYSTEM |
| Document No. | NTPC:2100-109-PVM-Y-005C,BHEL:PE-V0-466-(571-13000-A)-A217 |

| | | |
|----|-----------------------|---|
| 7 | Quantity | As per System requirement |
| 8 | Hydrostatic Pressure | As per standard IS:1239/3589 - Hydrostatic test Pressure will be 5 MPa |
| 9 | Max. working Pressure | 4.5 Kg/sq. cm |
| 10 | Design Pressure | 1.5 times the working pressure |
| 11 | Painting Details | As per Technical specification |
| 12 | Random Length of Pipe | Approx. 6 Mtr. |
| 13 | Pipe end details | Bevel end for 65 NB and above Plain end for sizes 50 NB and below. Drain/ Overflow Pipe - Screwed |

Table 4 Dimensions and Nominal Mass of Steel Tubes — Medium
(Clause 8 1)

| Nominal Bore | Outside Diameter | | Thickness | Mass of Tube | |
|--------------|------------------|---------|-----------|--------------|----------------------|
| | Maximum | Minimum | | Plain End | Screwed and Socketed |
| mm | mm | mm | mm | kg/m | kg/m |
| (1) | (2) | (3) | (4) | (5) | (6) |
| 6 | 10.6 | 9.8 | 2.0 | 0.404 | 0.407 |
| 8 | 14.0 | 13.2 | 2.3 | 0.641 | 0.645 |
| 10 | 17.5 | 16.7 | 2.3 | 0.839 | 0.845 |
| 15 | 21.8 | 21.0 | 2.6 | 1.21 | 1.22 |
| 20 | 27.3 | 26.5 | 2.6 | 1.56 | 1.57 |
| 25 | 34.2 | 33.3 | 3.2 | 2.41 | 2.43 |
| 32 | 42.9 | 42.0 | 3.2 | 3.10 | 3.13 |
| 40 | 48.8 | 47.9 | 3.2 | 3.56 | 3.60 |
| 50 | 60.8 | 59.7 | 3.6 | 5.03 | 5.10 |
| 65 | 76.6 | 75.3 | 3.6 | 6.42 | 6.54 |
| 80 | 89.5 | 88.0 | 4.0 | 8.36 | 8.53 |
| 100 | 115.0 | 113.1 | 4.5 | 12.2 | 12.5 |
| 125 | 140.8 | 138.5 | 4.8 | 15.9 | 16.4 |
| 150 | 166.5 | 163.9 | 4.8 | 18.9 | 19.5 |

Table 5 Dimensions and Nominal Mass of Steel Tubes — Heavy
(Clause 8 1)

| Nominal Bore | Outside Diameter | | Thickness | Mass of Tube | |
|--------------|------------------|---------|-----------|--------------|----------------------|
| | Maximum | Minimum | | Plain End | Screwed and Socketed |
| mm | mm | mm | mm | kg/m | kg/m |
| (1) | (2) | (3) | (4) | (5) | (6) |
| 6 | 10.5 | 9.8 | 2.6 | 0.487 | 0.490 |
| 8 | 14.0 | 13.2 | 2.9 | 0.765 | 0.769 |
| 10 | 17.5 | 16.7 | 2.9 | 1.02 | 1.03 |
| 15 | 21.8 | 21.0 | 3.2 | 1.44 | 1.45 |
| 20 | 27.3 | 26.5 | 3.2 | 1.87 | 1.88 |
| 25 | 34.2 | 33.3 | 4.0 | 2.93 | 2.95 |
| 32 | 42.9 | 42.0 | 4.0 | 3.79 | 3.82 |
| 40 | 48.8 | 47.9 | 4.0 | 4.37 | 4.41 |
| 50 | 60.8 | 59.7 | 4.5 | 6.19 | 6.26 |
| 65 | 76.6 | 75.3 | 4.5 | 7.93 | 8.05 |
| 80 | 89.5 | 88.0 | 4.8 | 9.90 | 10.1 |
| 100 | 115.0 | 113.1 | 5.4 | 14.5 | 14.8 |
| 125 | 140.8 | 138.5 | 5.4 | 17.9 | 18.4 |
| 150 | 166.5 | 163.9 | 5.4 | 21.3 | 21.9 |

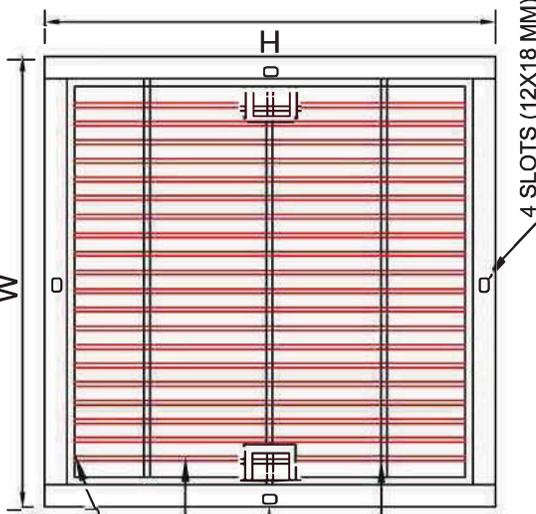
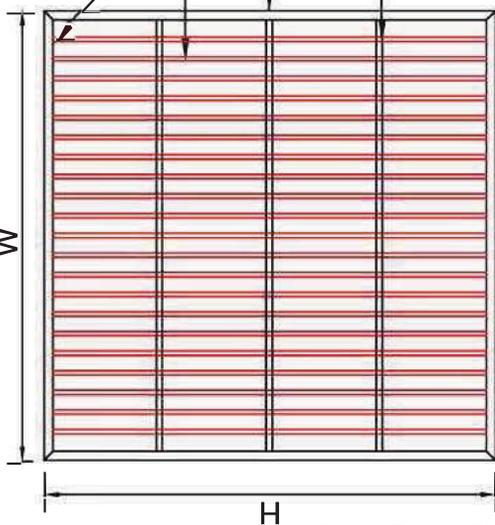
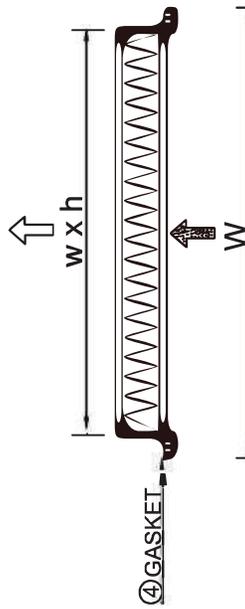
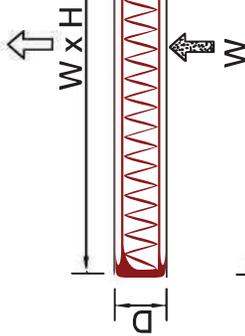
KORBA FGD**COMPLIANCE SHEET ON TDS AND GA OF FILTERS FOR AC AND VENTILATION SYSTEM
DOC NO. BHEL - PE-V0-466-(571-13000-A)-A216, NTPC - 2100-109-PVM-Y-005B, R01**

| SI No. | NTPC LIMITED COMMENTS ON RO | BHEL / REPLY | NTPC LIMITED REPLY |
|---------------|---|--|---------------------------|
| 1 | Average synthetic dust wt. arrestance (Equivalent Efficiency) 90% Down to 10 micron : Check wrt specification. | Average arrestance of 65 - 80 % when tested in accordance with BS:6540/ASHRAE – 52 – 76 / EN-779 is specified in specification and same is mentioned in the Technical Datasheet as well. Gravimetric Efficiency of 90% down to 10 Microns is equivalent to Average Arrestance of 65 to 80%. As per comment, the equivalent efficiency is removed from the TDS. | |
| 2 | Size: 610x610x50mm Deep/ 610x305x50mm Deep BHEL to check Minimum 300mm with 2.4 m/sec. | Inadvertently it is mentioned as 50mm Deep. Corrected in the revised documents. However, the GA Drawing carries the correct depth as 300 Deep. | |

TECHNICAL DATA SHEET FOR PRE FILTERS

| | | |
|----|---------------------------------------|---|
| 1 | Make | As per approved vendor list |
| 2 | Application (Location) | Suction of AHU, Fresh Air Fan Discharge, Supply Air Fan Discharge |
| 3 | Frame type | Cassette (Box)/ Flange |
| 4 | Size | 610x610x50mm Deep/ 610x305x50mm Deep |
| 5 | Qty (Nos) | As per Approved Drawing |
| 6 | Maximum Face velocity | 2.5 m/sec |
| 7 | Rated Air Flow (CMH/CFM) | 3350/1971 |
| 8 | Initial pressure drop | ≤ 5 mm of WC |
| 9 | Final pressure drop | Up to 7.5 mm of WC |
| 10 | Average synthetic dust wt. arrestance | 65% to 80% As per BS:6540/ASHRAE-52-76/EN779 |
| 11 | Frame material | GI sheet 18 G (1.29 ± 0.12mm) as per IS 277 |
| 12 | Filter Media | Washable non-woven synthetic Fibre or high density polyethylene (HDPE) media. (Washable & fire retardant and resistant to moisture, fungi, bacteria & frost) with HDPE mesh on air entry side & Al expanded mesh on air exit side |
| 13 | Filter Media Basic Weight/ Thickness | 120 ± 10% GSM / > 4 mm |
| 14 | Media sealing | Epoxy |
| | | |
| 16 | Spacers | Al sheet 20 G (0.91 ± 0.08 mm) as per IS 737 |
| 17 | Aesthetics | Clean external surface, No adhesive on frame |
| 18 | Filter cleaning | By compressed air/ water |
| 19 | Inspection & Testing | As per approved QAP |
| 20 | Filter Sealing | Neoprene sponge rubber sealing shall be provided on either face of the filter frame |

PRE FILTER (BOX TYPE / FLANGE TYPE)



BILL OF MATERIAL

| S.No | ITEM | MATERIAL | QTY | REMARKS |
|------|--------------|------------------------|--------|------------------|
| 1 | FILTER FRAME | GJ Sheet 18 GAUGE | 01 Nos | |
| 2 | FILTER MEDIA | HDPE WIRE MESH | 01 Set | *As per Detail |
| 3 | SEALING | EPOXY | 01 Set | |
| 4 | SPACER | AL 20 GAUGE | 03 Nos | |
| 5 | GASKET | Neoprene Sponge Rubber | 01 Set | Flange type only |

NOTE:-

FILTER MEDIA : Thickness 4.0-5.0 mm Basic
 Weight - 100 ± 10% GSM
 FILTER MEDIA No of Folds:- 11 ± 1/RFT
 Sheet Thickness: GI sheet 18 G (1.25 ± 0.12 mm)
 AISheet 20 G-0.91 ± 0.08 mm

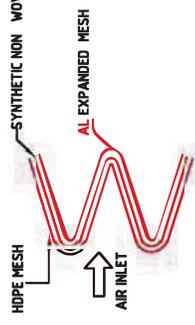
NOTE:-

DIMENSIONS FOR FLANGE TYPE

| S. No. | H | H ± 0.3 | W | W ± 0.3 | D | D ± 2 |
|--------|-----|---------|-----|---------|----|-------|
| 1 | 610 | 610 | 550 | 550 | 50 | 50 |
| 2 | 305 | 305 | 610 | 610 | 50 | 50 |
| 3 | 610 | 610 | 305 | 305 | 50 | 50 |

DIMENSIONS FOR BOX TYPE

| S. No. | H | H ± 0.3 | W | W ± 0.3 | D | D ± 2 |
|--------|-----|---------|-----|---------|----|-------|
| 1 | 610 | 610 | 610 | 610 | 50 | 50 |
| 2 | 610 | 610 | 305 | 305 | 50 | 50 |
| 3 | 305 | 305 | 610 | 610 | 50 | 50 |



*** FILTER MEDIA DETAIL**

DWG TITLE:- PRE FILTER BOX / FLANGE TYPE
 PROJECT : 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD
 Customer: NTPC Limited
 EPC Contractor: BHEL
 Contractor: Advance Ventilation Pvt Ltd.

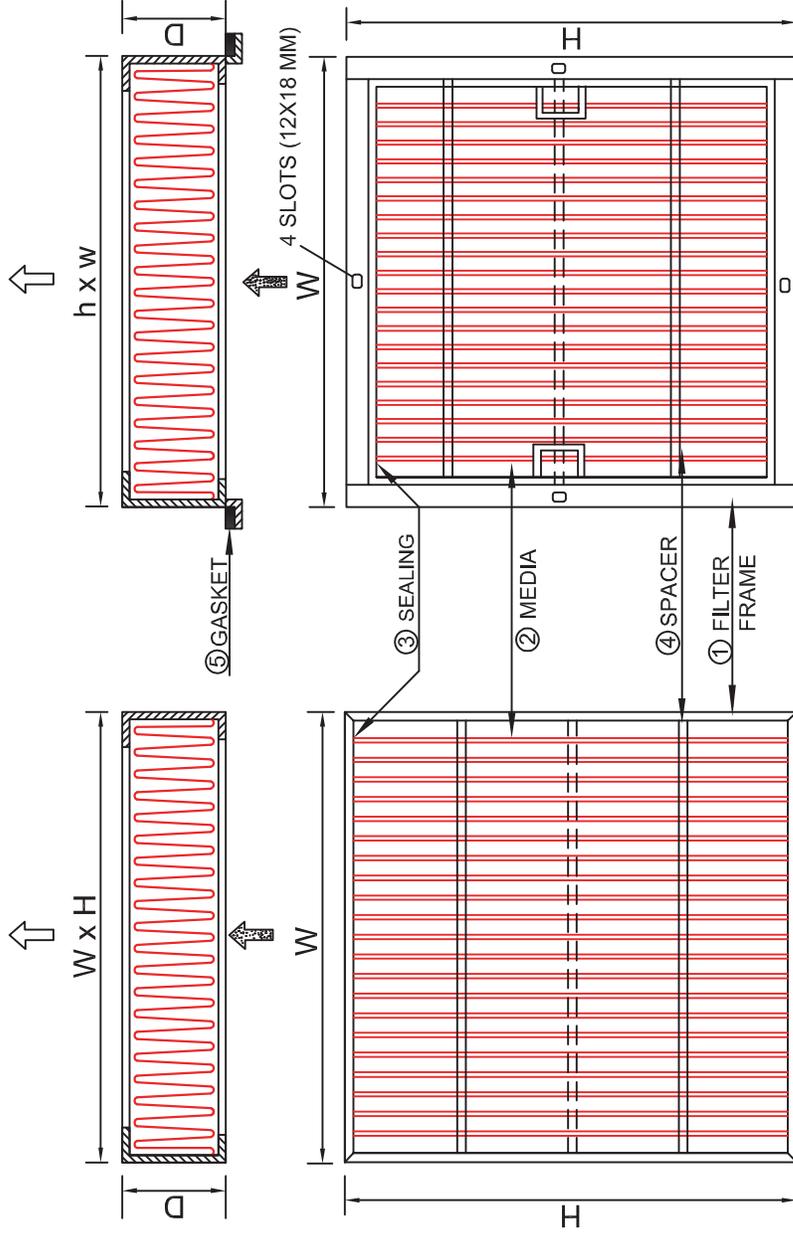
REVISION DETAILS

| REV NO. | REV DATE | COMMENTS |
|---------|----------|----------|
| | | |
| | | |
| | | |

TECHNICAL DATA SHEET FOR FINE FILTERS

| | | |
|----|---------------------------------------|---|
| 1 | Make | As per approved vendor list |
| 2 | Application (Location) | AHU Discharge, Fresh Air Fan Discharge, Supply Air Fan Discharge |
| 3 | Frame type | Cassette (Box)/ Flange |
| 4 | Size | 610x610x300mm Deep/ 610x305x300mm Deep |
| 5 | Qty (Nos) | As per Approved Drawing |
| 6 | Maximum Face velocity | 2.4 m/sec |
| 7 | Rated Air Flow (CMH/CFM) | 3200/1883 |
| 8 | Initial pressure drop | ≤ 10 mm of WC |
| 9 | Final pressure drop | 25 mm of WC |
| 10 | Average synthetic dust wt. arrestance | >90% As per BS:6540/ASHRAE-52-76/EN779 |
| 11 | Frame material | GI sheet 18 G (1.29 ± 0.12mm) as per IS 277 |
| 12 | Spacers | Al sheet 20 G (0.91 ± 0.08 mm) as per IS 737 |
| 13 | Filter Media | Washable non-woven synthetic Fibre or high density polyethylene (HDPE) media. (Washable & fire retardant and resistant to moisture, fungi, bacteria & frost) with HDPE mesh on air entry side & Al expanded mesh on air exit side |
| 14 | Filter Media Basic Weight/ Thickness | 200 ± 10% GSM / > 1.5 mm |
| 15 | Media sealing | Epoxy |
| 16 | Aesthetics | Clean external surface, No adhesive on frame |
| 17 | Filter cleaning | By compressed air/ water |
| 18 | Inspection & Testing | As per approved QAP |
| 19 | Filter Sealing | Neoprene sponge rubber sealing shall be provided on either face of the filter frame |

FINE FILTER BOX / FLANGE TYPE



BILL OF MATERIAL

| S.No | ITEM | MATERIAL | QTY | REMARKS |
|------|--------------|------------------------|--------|------------------|
| 1 | FILTER FRAME | GI Sheet 18G | 01 Nos | |
| 2 | FILTER MEDIA | HDPE WIRE MESH | 01 Set | *As per Detail |
| 3 | SEALING | EPOXY | 01 Set | |
| 4 | SPACER | AL.20 GAUGE | 03 Nos | |
| 5 | GASKET | Neoprene sponge rubber | 01 Nos | Flange type only |

NOTE:-

FILTER MEDIA : Thickness 1.5-1.6 mm
 Basic Weight - 165± 5% GSM
 FILTER MEDIA No of Pleats:-11 ±1/RFT
 Sheet Thickness: G sheet 18 G - 1.29 ± 0.12 mm
 A Sheet 20 G - 0.91 ± 0.08 mm

NOTE:-

DIMENSIONS FOR BOX TYPE

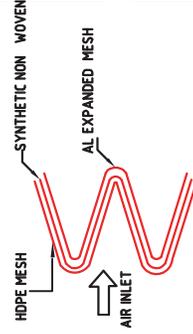
| S. No. | H +0/-3 | W +0/-3 | D ± 2 |
|--------|---------|---------|-------|
| 1 | 610 | 610 | 300 |
| 2 | 610 | 305 | 300 |
| 3 | 305 | 610 | 300 |

DIMENSIONS FOR FLANGE TYPE

| S. No. | H/h +0/-3 | W/w +0/-3 | D ± 2 |
|--------|-----------|-----------|-------|
| 1 | 610 | 610 | 300 |
| | 550 | 550 | |
| 2 | 305 | 610 | 300 |
| | 245 | 550 | |
| 3 | 610 | 305 | 300 |
| | 550 | 245 | |

REVISION DETAILS

| REV NO. | REV DATE | COMMENTS |
|---------|----------|----------|
| | | |
| | | |
| | | |



* FILTER MEDIA DETAIL

DWG TITLE:- PRE FILTER BOX / FLANGE TYPE

PROJECT : 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD

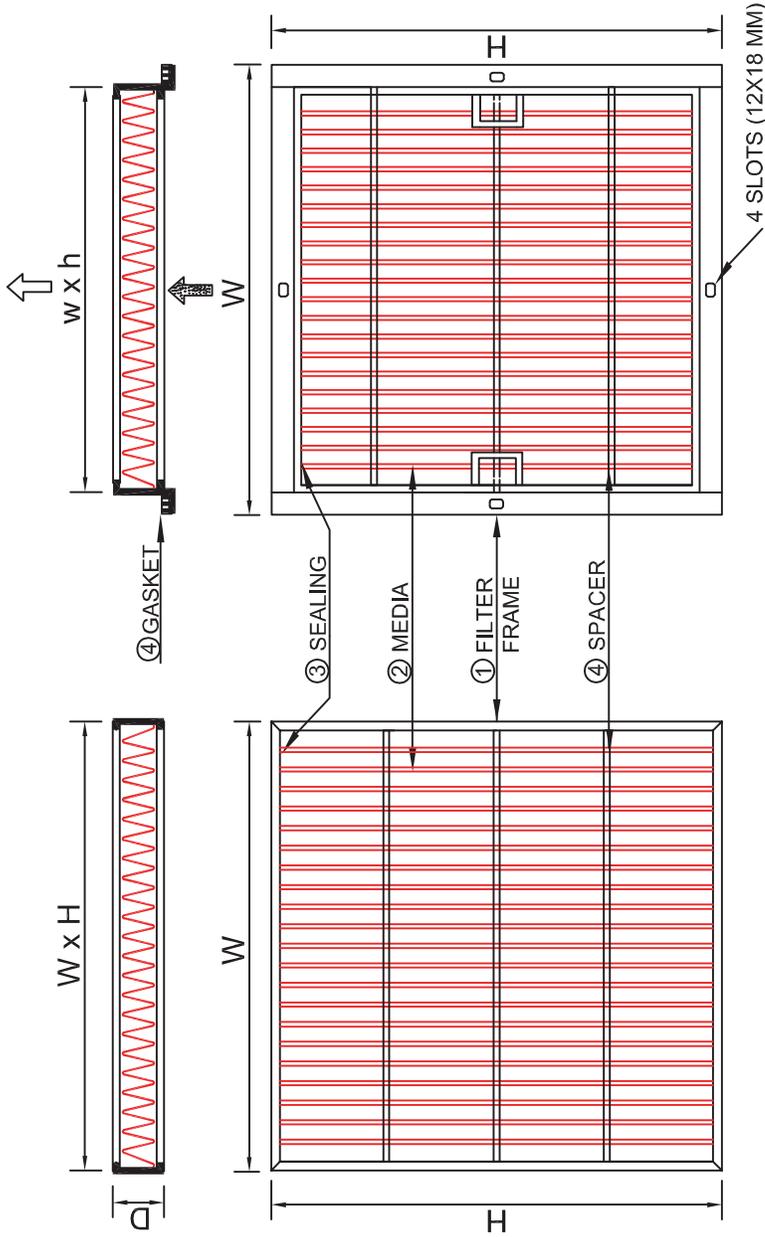
Customer: NTPC Limited

EPC Contractor: BHEL

TECHNICAL DATA SHEET FOR WATER REPELLANT FILTERS

| | | |
|----|---------------------------------------|--|
| 1 | Make | As per approved vendor list |
| 2 | Application (Location) | Unitary Air Filtration (UAF Unit) |
| 3 | Frame type | Cassette (Box)/ Flange |
| 4 | Size | 610x610x50mm Deep/ 610x305x50mm Deep |
| 5 | Qty (Nos) | As per Approved Drawing |
| 6 | Maximum Face velocity | 2.5 m/sec |
| 7 | Rated Air Flow (CMH/CFM) | 3350/1971 |
| 8 | Initial pressure drop | ≤ 5 mm of WC at rated flow |
| 9 | Final pressure drop | Upto 7.5 mm of WC |
| 10 | Average synthetic dust wt. arrestance | 65% to 80% As per BS:6540/ASHRAE-52-76/EN779 |
| 11 | Frame material | GI sheet 18 G (1.29 ± 0.12mm) as per IS 277 |
| 12 | Spacers | Al sheet 20 G (0.91 ± 0.08 mm) as per IS 737 |
| 13 | Filter Media | Multiple layers of Nylon Mesh and supported by AL Expanded mesh, (Water Repellent Type) |
| 14 | Media sealing | Epoxy |
| 15 | Aesthetics | Clean external surface, No adhesive on frame |
| 16 | Filter cleaning | By compressed air/ water |
| 17 | Filter Sealing | Neoprene sponge rubber sealing shall be provided on either face of the filter frame |

PRE FILTER(BOX TYPE / FLANGE TYPE)



NOTE:-

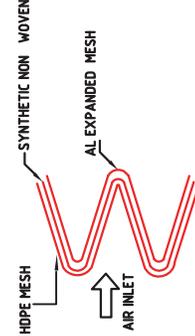
FILTER MEDIA : Thickness 4.0-5.0 mm
 Basic Weight -100± 10% GSM
 FILTER MEDIA No of Folds:-11 ±1/RFT
 Sheet Thickness: GIsheet 18G -1.29 ± 0.12 mm
 AlSheet 20 G-0.91 ± 0.08 mm

BILL OF MATERIAL

| S.No | ITEM | MATERIAL | QTY | REMARKS |
|------|--------------|----------------------------|--------|------------------|
| 1 | FILTER FRAME | GI Sheet 18G | 01 Nos | |
| 2 | FILTER MEDIA | WATER REPELLENT NYLON TYPE | 01 Set | *As per Detail |
| 3 | SEALING | EPOXY | 01 Set | |
| 4 | SPACER | AL 20 GAUGE | 03 Nos | |
| 5 | GASKET | Neoprene Rubber | 01 Set | Flange type only |

NOTE:-

DWG TITLE:- WATER REPELLENT FILTER BOX /FLANGE TYPE
 PROJECT : 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD
 Customer: NTPC Limited
 FPC Contribution: BHEL



*** FILTER MEDIA DETAIL**

DIMENSIONS FOR FLANGE TYPE

| S. No. | H ±0/-3 | W ±0/-3 | D ±2 |
|--------|---------|---------|------|
| 1 | 610 | 610 | 50 |
| 2 | 305 | 610 | 50 |
| 3 | 610 | 305 | 50 |

DIMENSIONS FOR BOX TYPE

| S. No. | H ±0/-3 | W ±0/-3 | D ±2 |
|--------|---------|---------|------|
| 1 | 610 | 610 | 50 |
| 2 | 610 | 305 | 50 |
| 3 | 305 | 610 | 50 |

REVISION DETAILS

| REV NO. | REV DATE | COMMENTS |
|---------|----------|----------|
| | | |
| | | |
| | | |

| | |
|---|---|
| PROJECT: 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | WRITE-UP & CONTROL PHILOSOPHY FOR A/C AND VENTILATION SYSTEM |
| BHEL DOC. NO. : PE-V0-466-(571-13000-A)-A403 | DATE: 27.08.2022 |

1.0 THE AIR CONDITIONING SYSTEM & VENTILATION SYSTEM COVERS FOLLOWING AREAS.

- 1.1 Air-Conditioning System at FGD Building.
- 1.2 Ventilation System at FGD Building.

Outdoor and Indoor Design Conditions based on which system is designed is given below: -
The outside design conditions considered are as follows:

| | Summer | Monsoon | Winter |
|-----------------|---------------|----------------|---------------|
| DBT (°C) | 43.9 | 38.4 | 15 |
| WBT (°C) | 25.6 | 27.8 | 10 |
| RH (%) | 23 | 45 | 53 |

The inside design conditions to be maintained are as follows: -

Temperature: 24°C ± 1°C
Relative humidity: 50% ± 5%

2.0 EQUIPMENT DETAILS OF AIR CONDITIONING & VENTILATION SYSTEM OF FGD BUILDING.

#The AC system in FGD Building area consists of the following major equipments

- 2.1 6 nos. Air Cooled Condensing Units are located at Terrace of EL (+) 19.2 M of FGD Building.
- 2.2 6nos. (3W+3S) DX-AHU's located at EL(+)19.2 M of FGD Building along with Fresh Air fan, heaters, pan humidifier, temperature & RH. Sensors, Fire Dampers etc. to provide air conditioning to FGD Control Room at EL (+) 13.6M.

#The Ventilation system in FGD Building area consists of the following major equipments

- 2.3 2Nos. (2W+0S) UAF located at EL (+) 19.2M of FGD Building.
- 2.4 2no. (2W+0S) PUMP located at EL (+) 19.2M of FGD Building.
- 2.5 Fire Damper located at EL (+) 13.6M of FGD Building & Other elevation as per Ducting Layout

3.0 DETAILED OPERATION & CONTROL OF AC SYSTEM.

Above equipments of AC System & Ventilation System of FGD Building shall be controlled by DDCMIS (BHEL Scope).

DDCMIS (BHEL's scope) system shall consist of following Graphics pages in which P&I diagram are to be prepared with all necessary Pop-up windows Display parameters & Alarm Configuration.

| | |
|---|---|
| PROJECT: 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | WRITE-UP & CONTROL PHILOSOPHY FOR A/C AND VENTILATION SYSTEM |
| BHEL DOC. NO. : PE-V0-466-(571-13000-A)-A403 | DATE: 27.08.2022 |

1. DDCMIS for AC System at EL (+) 13.6 M of FGD Building.
2. DDCMIS for Alarm Message.

Each DDCMIS shall have POP of windows by which plant is operated.

Each Graphics shall have **Auto & Manual** Selection by which operator is to decide in which mode system will run. Before that Operator is to do selection of Standby and Working drive from respective Graphics page. When **Manual mode** is selected in respective Graphics then individual equipment of that particular area can be operated by actuation of start & stop PB (soft button available in POP of respective drive) from Graphics. When **Auto mode** operation is selected for any particular Graphics then total system of that particular area operates automatically in sequence as per the preset program in DDCMIS provided that **“Auto start”** Command is given. Similarly Auto operation will be stopped in sequence if **“Auto Stop”** Command is given from Graphics. All drives will have individually **Service / Maintenance** mode selection in respective POP-UP WINDOWS but by default they will be in Service mode only. In duty cycle sequence preset running time can be changed through Graphics and run time duration completed will be continuously displayed in Graphics until reset by operator. When preset run time is completed then there will alarm with message in Graphics. Accordingly, operator will take decision for further selection.

4.0 DETAILED OPERATION OF DRIVES IN MANUAL MODE FOR FGD BUILDING.

STEP-1

Operation of DX - AIR HANDLING UNIT (DX-AHU)

3Nos. AHU Fan is to be selected for **working mode** from DDCMIS. Rest 3 Nos. is to be kept in **Standby mode**.

All fire dampers open & fire signal should be healthy before starting the AC System in AUTO/Manual Mode.

Now **“Start”** command for any selected DX-AHU can be given from the Pop-Up Windows of respective drive after found following **permissive interlock** signal healthy However the Corresponding ACCU will start automatically after DX-AHU run feedback available.

DX-AHU Start permissive.

- AHU is in Service mode.
- No fire signal.
- AHU is in working mode.
- No **trip signal** from MCC
- Open Feedback of all fire dampers.
- Off signal feedback is available from MCC.

| | |
|---|---|
| PROJECT: 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | WRITE-UP & CONTROL PHILOSOPHY FOR A/C AND VENTILATION SYSTEM |
| BHEL DOC. NO. : PE-V0-466-(571-13000-A)-A403 | DATE: 27.08.2022 |

If above interlocks are healthy then start command shall be issued from DDCMIS of respective drive (**Selected working AHU**) to start working AHU.

Following **protection features** have been considered to trip the running Dx-AHU Fan.

- AHU Fan will be tripped immediately if fire signal exist.
- AHU Fan will be tripped, if pressure switch status is not healthy & ON feedback is not received after certain time (10 seconds) when a start command is issued. From DDCMIS screen AHU unit will be started and ACCU will start automatically after receiving the run feed back of corresponding DX-AHU fan.

Following are the **Status indication** details in DDCMIS for AHU.

- 1) Respective AHU fan running status will be displayed in DDCMIS as red color.
- 2) Respective AHU fan off status will be displayed in DDCMIS as Green color.
- 3) Trip status will be alarm message in DDCMIS as Yellow Color (Blinking)

When the AHU start, following conditions will be also monitored & controlled through DDCMIS

- If **Fine filter** system in any of the AHU is **choked** there will be alarm at Graphics. Set point 150 Pascal (adjustable).
- If Air pressure is not healthy at outlet of any AHU then there will be alarm at **DDCMIS**. Set point 250 pascal (adjustable).

STEP-2

(Fresh air fan Operation)



2 Nos. Fresh air fan is provided inside each AHU Room FGD Building. It will be started after running of any AHU. Its **Permissive signal** for operation is as below.

- ✓ No **trip signal** from MCC.
- ✓ Off signal feedback is available from MCC
- ✓ No fire signal.
- ✓ At least any one AHU is in running condition.
- ✓ No MCC Disturbed Signal from MCC

Now if all above permissive signals are available then FAF Fan drive can be started from respective popup windows from DDCMIS.

Following **protection features** have been considered to trip the running FAF Fan.

| | |
|---|---|
| PROJECT: 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | WRITE-UP & CONTROL PHILOSOPHY FOR A/C AND VENTILATION SYSTEM |
| BHEL DOC. NO. : PE-V0-466-(571-13000-A)-A403 | DATE: 27.08.2022 |

- ✓ Start command from DDCMIS to MCC will be active only for few seconds (say 5 sec). However, alarm signal can be displayed on Graphics as “drive fail to start” if drive will not be started within 5sec.
- ✓ FA fan will be tripped if DDCMIS receives Fire signal from Fire Alarm Panel.
- ✓ FA fan will be tripped if DDCMIS receives trip feedback of all AHU's.

Following are the **Status indication** details of FA Fan in DDCMIS.

- ✓ Respective FA fan running status will be displayed in DDCMIS as red color.
- ✓ Respective FA fan off status will be displayed in DDCMIS as Green color.
- ✓ Trip status will be alarm message in DDCMIS as Yellow Color (Blinking).

STEP-3

(Air Cooled Condensing Unit)

6 No ACCU is provided at Terrance of FGD Building. It will be started based on the Run Feed back of AHU.

The ACCU will be operational based on Auto change over taken by DDCMIS Further in case of fault in AHU-1 or AHU-2,3,4,5 & 6 then its respective ACCU will also be tripped. Standby ACCU and corresponding AHU will be started automatically.

Following are the **Status indication** details of ACCU in **DDCMIS**.

- ✓ Respective ACCU running status will be displayed in **DDCMIS** as red color.
- ✓ Respective ACCU off status will be displayed in **DDCMIS** as Green color.
- ✓ Trip status will be alarm message in **DDCMIS** as Yellow Color (Blinking)

#DUCT HEATER & PAN HUMIDIFIER OPERATION

Duct heaters & Pan Humidifier (both are provided inside AHU room) will be controlled & monitored automatically by the logic depending on the value of return Air (RA) Temperature & RH (relative humidity) with respect to the reference set point. Set point will be entered in DDCMIS and ON OFF status of respective heater & Pan Humidifier can be seen in DDCMIS screen.

Pan Humidifier will be functioning at lower limit of RH while heaters will be functioning at upper limit of RH.Heater will be also functioning at lower value of temperature. Heaters shall be interlocked with running of AHUs, RA temperature & RA humidity & Airstat while Pan Humidifier is interlocked with running AHUs, RA temp & humidity & safety thermostat (called as Gysrstat- Proprietary item of Humidifier).

Duct Heater Permissive:

| | |
|---|---|
| PROJECT: 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | WRITE-UP & CONTROL PHILOSOPHY FOR A/C AND VENTILATION SYSTEM |
| BHEL DOC. NO. : PE-V0-466-(571-13000-A)-A403 | DATE: 27.08.2022 |

- Return Air temperature in AHU room is less than Low Reference set point (22 degree C-adjustable) with cut-off Reference set point (24 degree C- adjustable)

OR

Return Air RH in AHU room is more than Reference set point (55%-adjustable) with Cut-off at 50% (adjustable)

- Heater gysersat is healthy (integral part of heater)
- Duct air pressure is healthy (Airstat)

Pan Humidifier Permissive:

- Return Air RH in AHU room is less than Reference set point (45%-adjustable) with cut-off at 50% (adjustable)
- Humidifier gysersat is healthy (integral part of humidifier)
- Humidifier water level healthy (integral part of humidifier)

5.0 DETAILED OPERATION OF DRIVES IN *AUTO MODE* FOR FGD BUILDING.

5.1 AUTOMATIC START SEQUENCE

Before giving “**Auto Start**” command from DDCMIS, operator is to **select** desired drives in working mode which need to be started in **Auto Mode**.

Now “**Auto Start**” command can be given from DDCMIS then DDCMIS will immediately scan/check all interlocks (as explained in manual mode) and if found satisfactory will start all drives in the following sequence. Also incase of Working Mode Drive Tripping the standby will automatically start after checking the permissive as metioned above.

AUTO START SEQUENCE STEP-1

Selected Dx-AHU (Working mode) will start automatically. If any AHU fail to start or develops trouble during running, the standby Dx-AHU & corresponding ACCU (if it is selected in Standby mode) will start automatically.

AUTO START SEQUENCE STEP-2

- Fresh air fan of the respective AHU Room will also start automatically. If at least one AHU Fan Run feedback is available of respective AHU room.

AUTO START SEQUENCE STEP-3

Air Cooled Condensing Unit of the respective AHU will also start automatically. If the respective AHU. Fan Run Feedback is available.

When the AHU starts the duct heater or Pan Humidifier will also be controlled (on/off) & monitored by the DDCMIS depending on the value of RA temperature /RH with respect to the set point.

| | |
|---|---|
| PROJECT: 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | WRITE-UP & CONTROL PHILOSOPHY FOR A/C AND VENTILATION SYSTEM |
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Operation of AC system as per above stated process will remain in running condition until unless "Auto Stop" command is given from DDCMIS.

5.1 AUTOMATIC STOP SEQUENCE

Now "Auto Stop" command can be given from DDCMIS then DDCMIS will immediately Stop all drives in the following sequentially.

- Fresh Air Fan will stop.
- All Dx-AHU will stop.
- All ACCU will stop.

Hence Air-conditioning system will stop automatically.

6.0 DETAILED OPERATION & CONTROL OF VENTILATION SYSTEM.

Above described ventilation system equipment's (UAF and UAF-PUMP) of FGD Building shall be controlled by DDCMIS (BHEL Scope).

DDCMIS (BHEL's scope) system shall consist of following Graphics pages in which P&I diagram are to be prepared with all necessary Pop-up windows Display parameters & Alarm Configuration.

1. Graphics for Auto & Manual operation selection for Ventilation System.
2. Graphics for Alarm Message.

Each Graphics shall have POP of windows by which plant is operated.

7.0 DETAILED OPERATION OF DRIVES IN MANUAL MODE FOR FGD BUILDING.

STEP-1

(Operation of UAF)

2No Containerized UAF is provided EL (+) 19.2M of FGD Building.

All fire dampers open & fire signal should be healthy before starting the Ventilation System in AUTO/Manual Mode.

Now "**Start**" command of UAF can be given from the Pop-Up Windows of respective drive. Upon

| | |
|---|---|
| PROJECT: 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | WRITE-UP & CONTROL PHILOSOPHY FOR A/C AND VENTILATION SYSTEM |
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receipt of the command the DDCMIS will check the following permissive/ Protection and will operate accordingly.

UAF Start permissive.

- ✓ No **trip signal** from MCC.
- ✓ Off signal feedback is available from MCC
- ✓ No fire signal.
- ✓ All fire dampers open feedback.

Now if all above permissive signals are available then UAF drive can be started from respective popup windows from DDCMIS.

Following **protection features** have been considered to trip the running UAF.

- ✓ Start command from DDCMIS to MCC will be active only for few seconds (say 5 sec). However, alarm signal can be displayed on Graphics as “drive fail to start” if drive will not be started within 5sec.
- ✓ UAF will be tripped if DDCMIS receives Fire signal from Fire Alarm Panel.

Following are the **Status indication** details of UAF in DDCMIS.

- ✓ Respective UAF running status will be displayed in DDCMIS as red color.
- ✓ Respective UAF off status will be displayed in DDCMIS as Green color.

Trip status will be alarm message in DDCMIS as Yellow Color (Blinking)

STEP-2

(Operation of UAF-PUMP)

2No UAF-PUMP is provided inside Containerized UAF EL (+) 19.2 M of FGD Building.

Now “**Start**” command of UAF-PUMP can be given from the Pop-Up Windows of respective drive. Upon receipt of the command the DDCMIS will check the following permissive/ Protection and will operate accordingly.

UAF-PUMP Start permissive.

- ✓ No **trip signal** from MCC.
- ✓ Off signal feedback is available from MCC
- ✓ Run Feedback of UAF is available from MCC
- ✓ UAF tank level is healthy (Above High-High level)

Now if all above permissive signals are available then UAF-PUMP drive can be started from

| | |
|---|---|
| PROJECT: 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | WRITE-UP & CONTROL PHILOSOPHY FOR A/C AND VENTILATION SYSTEM |
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respective popup windows from DDCMIS.

Following **protection features** have been considered to trip the running UAF-PUMP.

- ✓ Start command from DDCMIS to MCC will be active only for few seconds (say 5 sec). However, alarm signal can be displayed on DDCMIS as “drive fail to start” if drive will not be started within 5sec.
- ✓ UAF-PUMP will be tripped if DDCMIS receives OFF feedback from MCC.
- ✓ UAF tank level is not healthy and Below Low level.
- ✓ Pump will be tripped if outlet pressure does not develop (monitored through Pressure switch, set point 2.5 kg/cm²) within 30 second after start command.

Following are the **Status indication** details of UAF-PUMP in DDCMIS.

- ✓ Respective UAF running status will be displayed in DDCMIS as red color.
- ✓ Respective UAF off status will be displayed in DDCMIS as Green color.

Trip status will be alarm message in DDCMIS as Yellow Color (Blinking)

8.0 DETAILED OPERATION OF AWU/UAF SYSTEM IN AUTO MODE THROUGH DDCMIS

All fire dampers open & fire signal should be healthy before starting the Ventilation System in AUTO MODE.

Now “**Auto Start**” command can be given from DDCMIS then DDCMIS will immediately scan/check all interlocks (as explained in manual mode) and if found satisfactory will start all drives in the following sequence.

When the System is selected in the Auto mode the following sequence will be followed.

AUTO START SEQUENCE

- 1) First UAF will start.
- 2) Then UAF-PUMP will start.

Operation of UAF system as per above stated process will remain in running condition until unless “Auto Stop” command is given from Graphics.

| | |
|---|---|
| PROJECT: 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | WRITE-UP & CONTROL PHILOSOPHY FOR A/C AND VENTILATION SYSTEM |
| BHEL DOC. NO. : PE-V0-466-(571-13000-A)-A403 | DATE: 27.08.2022 |

AUTO STOP SEQUENCE

- 1) First UAF-PUMP will stop.
- 2) Then UAF will stop.

Hence UAF system will stop automatically.

NOTES:

- (1) All set points mentioned above can be changed as per site/ system requirements.
- (2) All the Start Permissive and Stop Protection for all drives will be same in manual and Auto mode both.
- (3) Instruments are provided as per approved P&ID.
- (4) All fire dampers shall be open and fire signal shall be healthy to start all drive in Auto/ manual mode.

9.0 LIST OF REFERENCE DOCUMENTS

- (1) **P&I DIAGRAM FOR AIR COOLED CONDENSING UNIT (DX-TYPE) FOR FGD BUILDING (PE-V0-466-(571-13000-A)-A102).**
NTPC DOC NO. 2100-109-PVM-F-005A
- (2) **P&ID FOR UAF UNIT FOR FGD BUILDING (PE-V0-466-(571-13000-A)-A104).**
NTPC DOC NO. 2100-109-PVM-F-005B

| TECHNICAL DATA SHEET | | Doc. No.: SALE-21105325 - 10 | Rev. 01 |
|---|---|---|---|
|  | PROJECT : NTPC-Korba Customer : NTPC Job no. : M22/DEL-19.BHEL NTPC document no. : 0270-109A-PVM-B-328 BHEL Doc. No.: PE-V0-466-(571-13000-A)-A204 ORDER NO : 22A-1477 | | 2100-109-PVM-Y-002B Dt.- 13- 02- 2023 |
| | S. No | Description | HORIZONTAL END SUCTION PUMP |
| General Information: | | | |
| 1. | Application | Water Pump | |
| 2. | Duty | Continuous | |
| 3. | Quantity | 1 | |
| 4. | Liquid | Water | |
| 5. | Specific Gravity of Liquid | 1.0 | |
| 6. | Temperature (Deg. C) | Ambient | |
| 7. | Pump Design & Testing Standard | IS 5120 / IS 9137 | |
| Specifications: | | | |
| 8. | Pump Make | FLOWMORE | |
| 9. | Pump Type | Horizontal End Suction Pump | |
| 10. | Pump Model / Size | F5625 / 125 x 100 mm | |
| 11. | No. of Stage | Single (1) | |
| 12. | Full Load Speed of Motor | 1470 rpm | |
| 13. | Capacity (M ³ /Hr.) | 84 M ³ /Hr | |
| 14. | Total Differential Head (Mtr.) | 30 M | |
| 15. | Shut Off Head (Mtr.) | 34.5 M | |
| 16. | Pump Efficiency | 73.5 % | |
| 17. | Pump Input (BKW) | 9.34 KW | |
| 18. | Motor Rating | 15 KW / 4P | |
| 19. | Motor Type | TEFC / Horizontal Induction Motor /IE-2 | |
| 20. | Type of Bearing Lubrication | Grease | |
| 21. | Type of Impeller | Enclosed | |
| 22. | Type of Pump Motor Coupling | Flexible (Spacer Type) | |
| 23. | Flange Drilling Standard | ANSI B16.5, 150 LBS | |
| 24. | NPSHR (At duty point) | 2.3 M | |
| 25. | Noise Level | 85 dBA at 1 M | |
| 26. | Vibration Level | 75 Microns | |
| 27. | Bearing Type / Make | Antifriction (SKF / FAG) | |
| Material of Construction | | | |
| 28. | Casing | 2% Ni. C.I. (IS-210, FG 260) | |
| 29. | Impeller | BRONZE (IS:318, LTB-II) | |

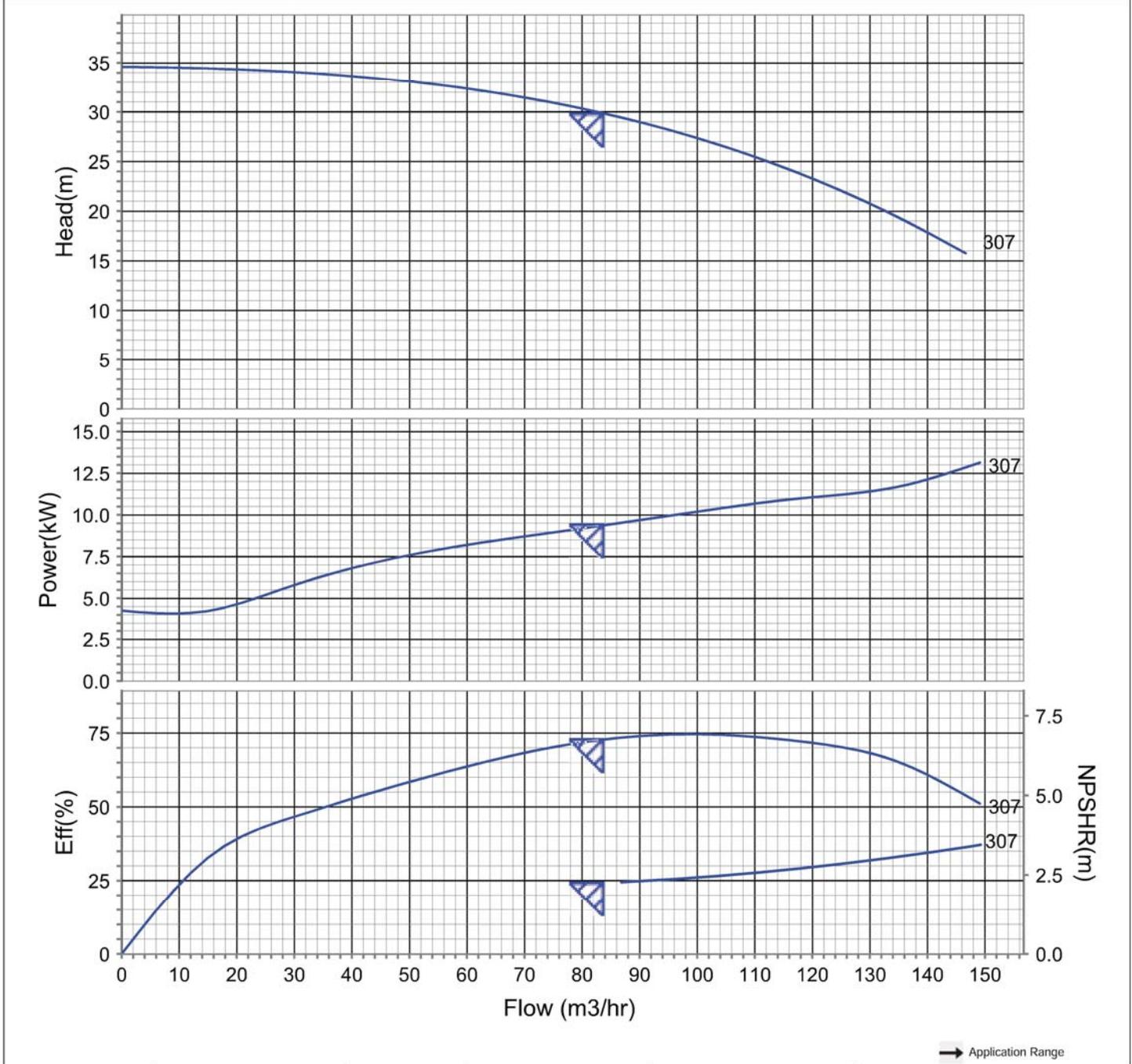
| | | |
|-----|-------------------------|--|
| 30. | Casing Wearing Ring | BRONZE (IS 318,LTB II) |
| 31. | Impeller Wearing Ring | BRONZE (IS:318, LTB-II) |
| 32. | Pump Shaft | ASTM A276 (S.S.-316) |
| 33. | Shaft Sleeve | ASTM A276 (S.S.-316) |
| 34. | Type of Sealing | Mechanical Seal |
| 35. | Mechanical Seal | Faces carbon v/s Si.C |
| 36. | Fasteners | M.S.-(IS-1367, Gr.- 4.6) |
| 37. | Companion Flange | M.S. (IS.-2062) |
| 38. | Bearings (Antifriction) | Bearing Steel (SKF/FAG)((6310 Z-C3)) |
| 39. | Base Plate | M.S. (FAB.)(IS - 2062) |
| 40. | Accessories | Base Frame, Coupling, Coupling Guard, Foundation Bolts, Companion flanges with Hardware. |

NOTE:

- 1) Inspection & Testing shall be as per approved QAP.

Performance Chart

| | | | | | | | |
|-------------|--|----------------|--|-------------------|--|---------------|--|
| Consultant | | - | | Liquid | | - | |
| Project | | NTPC KORBA | | Specific Gravity | | 1 | |
| Application | | WATER PUMP | | Viscosity | | 0 Cst | |
| Speed (RPM) | | 1470 | | Fluid Temperature | | Ambient Deg C | |
| PumpModel | | F-5625-125x100 | | Solid Size | | 10 mm | |
| Flow | | 84.0 m3/hr | | Head | | 30.0 m | |
| Stage | | 1 | | | | | |



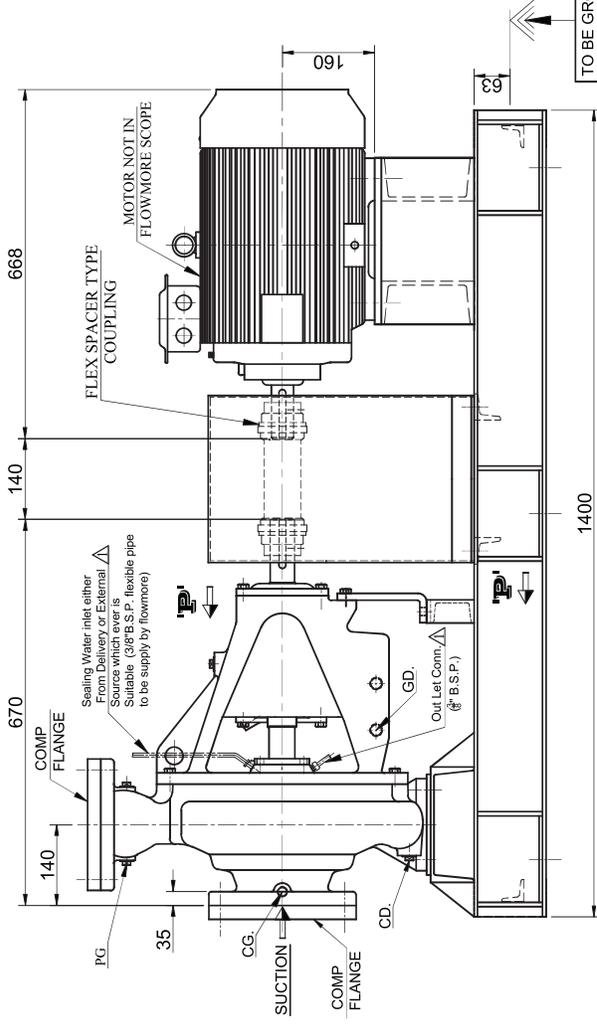
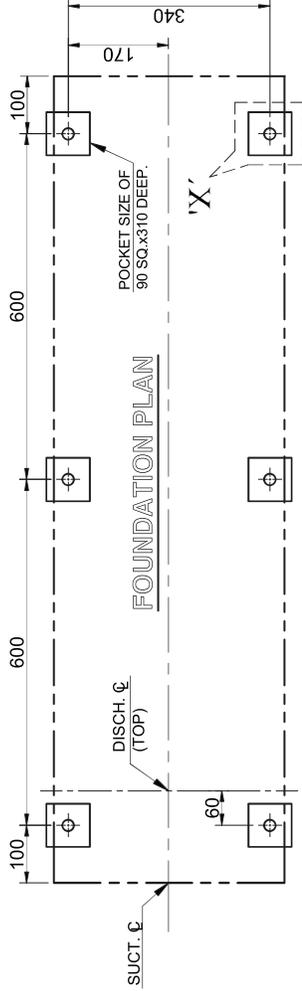
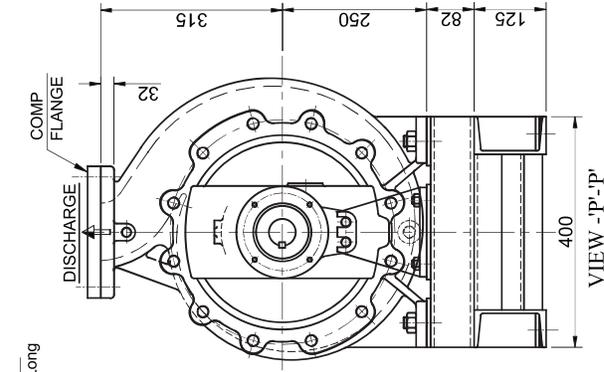
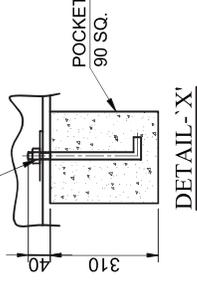
| | | | | | |
|------------------|---------|---------------|---------|----------------|-------------|
| Pump Input | 9.34 kW | NPSHA | Flooded | Size | Pump Nozzle |
| PrimeMover Power | 15.0 kW | NPSHR | 2.3 m | Suction (mm) | 125 |
| Eff | 73.5 % | Shut Off Head | 34.5 m | Discharge (mm) | 100 |

| | | | | | |
|------------|---|----------|---|------------------------|--------------|
| Tag Number | - | Offer No | - | Prepared By/Checked By | Priyank Jain |
| | | | | Date | |

FLANGE DETAIL AS PER ANSI B16.5, 150 LBS.
 SUCTION:----- 125 N.B. DISCHARGE:----- 100 N.B.
 FLANGE O.D.:--- 254 P.C.D.:----- 228.6
 P.C.D.:----- 190.5
 NO. OF HOLES:- 8
 DIA OF BOLTS:- M16

| | | |
|----|----------------|------------|
| PG | PRESSURE GAUGE | 3/8" B.S.P |
| CG | COMPOUND GAUGE | 3/8" B.S.P |
| CD | CASING DRAIN | 1/2" B.S.P |
| GD | GLAND DRAIN | 1/2" B.S.P |

6 NOS.-FOUNDATION BOLT
 'L' TYPE SIZE:-M20-2.5Px310 Long



TO BE GROUTED
 AFTER LEVELING
 & FASTENING
 OF SKID BASE

NOTE:-

1. DIMENSIONS ARE IN MM UNLESS OTHERWISE SPECIFIED.
2. DIRECTION OF PUMP ROTATION:- **COUNTER CLOCKWISE** WHEN LOOKING FROM DRIVING END.
3. STATIC LOAD (Pump Set With Motor) = 450 Kgs. (Approx.).
4. DYNAMIC LOAD (Pump Set With Motor) = 570 Kgs. (Approx.).

| MOTOR PARTICULARS | PUMP PARTICULARS (QTY. :- 02 Nos.) |
|-------------------|------------------------------------|
| MAKE | -- HEM |
| FRAME | -- 160L |
| POWER | -- 15 K.W. |
| SPEED | -- 1470 R.P.M. |
| VOLTS | -- 415 ±10% |
| PHASES | -- THREE |
| FREQUENCY | -- 50 Hz. |
| TYPE OF CONS. | -- H.S.S. |
| FIG. | -- F 5625 |
| SIZE | -- 125x100 (5"x4") |
| STAGE | -- SINGLE |
| SPEED | -- 1470 R.P.M. |
| CAPACITY | -- 84 Cu. M/hr. |
| HEAD | -- 30 Mtrs. |
| PUMP INPUT | -- 9.34 K.W. |
| (Sp. Gr. 1.0) | |
| EFFICIENCY | -- 73.5% |

| | | |
|-----------------|----------|------------|
| CHANGE AS MARKS | BALAM | 11.02.2023 |
| Rev.No. | REVISION | SIGN |
| | | DATE |

FLOWMORE LIMITED
 NEW DELHI

JOB NAME :- WATER PUMP

PROJECT :- A/c. N.T.P.C.-KORBA

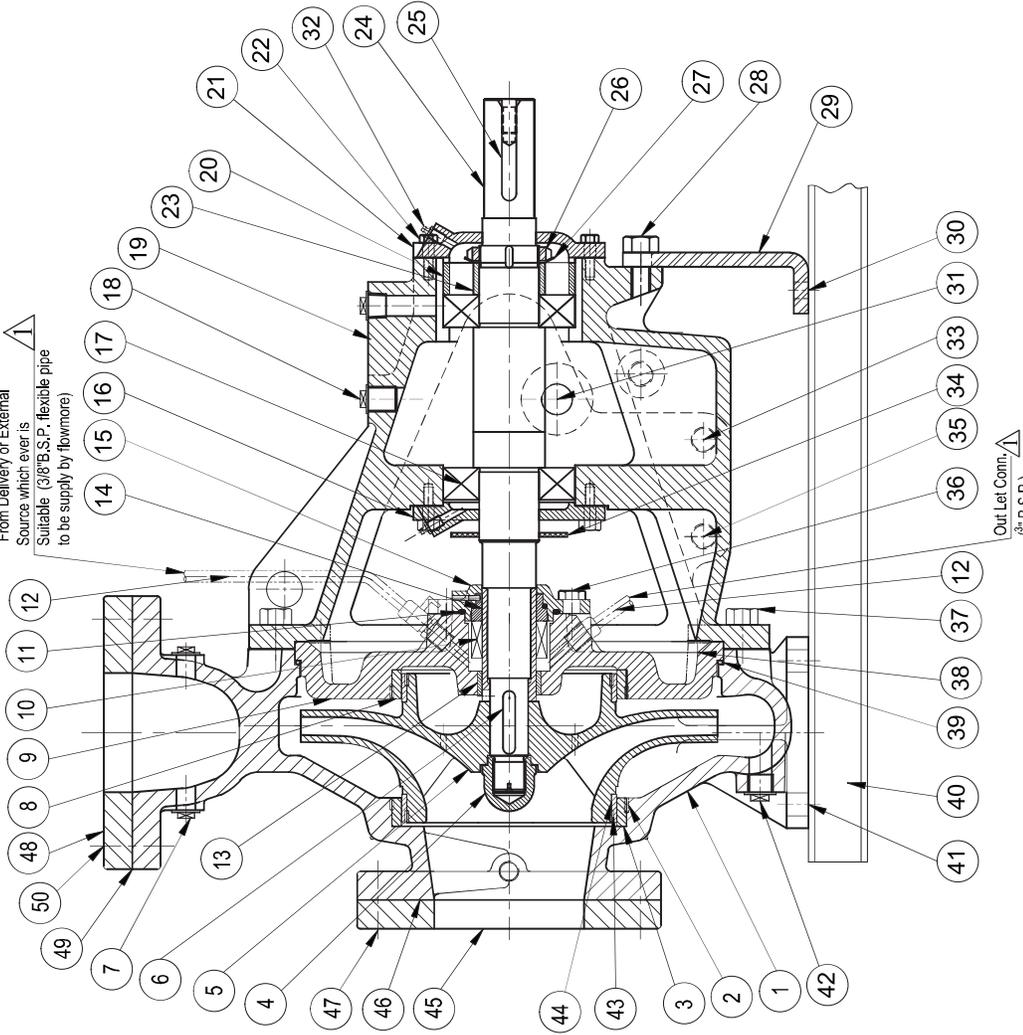
P.O. NO. :- 22A-1477 Dt.:- 04.10.2021

| | | | |
|-------|--------|------------|-----------------------------|
| DRN. | NAME | DATE | TITLE: |
| CHD. | SUNIL | 05.08.2022 | GENERAL ARRANGEMENT DRG. |
| APPD. | D.K.S. | 05.08.2022 | FOR |
| | P.K.S. | 05.08.2022 | HORIZONTAL END SUCTION PUMP |

| | | |
|-------------|-----------------|----|
| DRAWING NO. | GA-SALE21105325 | 10 |
| SCALE | | |
| SHEET | | |
| SIZE | A4 | 01 |



Sealing Water inlet either From Delivery or External Source which ever is Suitable (3/8" B.S.P. flexible pipe to be supply by flowmore)



Out Let Conn. (3/8" B.S.P.)

NOTE:-
DIRECTION OF PUMP ROTATION:- **COUNTER CLOCK WISE**, WHEN LOOKING FROM DRIVING END.

*** THESE ITEM ARE NOT SHOWN IN THIS DRAWING.**

| S. NO. | DESCRIPTION | QTY. | MATERIAL |
|--------|--|------|------------------------------|
| 52 | FLEXIBLE COUPLING (SPACER TYPE) | 01 | C.I. |
| 51 | COUPLING GUARD | 01 | M.S. (Fab.) |
| 50 | HEX. HD. CAP SCREW | 08 | M.S. (IS-1367, Gr.-4.6) |
| 49 | GASKET (DISCH. SIDE) | 01 | RUBBER |
| 48 | COMPANION FLANGE (DISCH. SIDE) | 01 | M.S. (IS-2062) |
| 47 | HEX. HD. CAP SCREW | 08 | M.S. (IS-1367, Gr.-4.6) |
| 46 | GASKET (SUC. SIDE) | 01 | RUBBER |
| 45 | COMPANION FLANGE (SUC. SIDE) | 01 | M.S. (IS-2062) |
| 44 | DOWEL PIN (Wearing Ring Impeller) | 04 | S.S.-304 |
| 43 | WEARING RING IMPELLER (Front & Back Side) | 02 | BRONZE (IS-318, LTB-II) |
| 42 | PIPE PLUG | 01 | M.I. |
| 41 | HEX. HD. BOLT WITH NUT & WASHER | 04 | M.S. (IS-1367, Gr.-4.6) |
| 40 | SKID BASE | 01 | M.S. (Fab.) (IS-2062) |
| 39 | O- RING | 01 | NITRILE RUBBER |
| 38 | STUD BOLT WITH NUT | 02 | M.S. (IS-1367, Gr.-4.6) |
| 37 | HEX. HD. CAP SCREW | 12 | M.S. (IS-1367, Gr.-4.6) |
| 36 | HEX. HD. CAP SCREW WITH WASHER | 04 | S.S.-316 |
| 35 | PIPE NIPPLE | 01 | STEEL |
| 34 | WATER SLINGER | 01 | RUBBER |
| 33 | PIPE PLUG | 02 | M.I. |
| 32 | GREASE RELEASE FITTING | 02 | STEEL |
| 31 | PIPE PLUG | 01 | M.I. |
| 30 | HEX. HD. BOLT WITH NUT & WASHER | 02 | M.S. (IS-1367, Gr.-4.6) |
| 29 | SUPPORT FOOT | 01 | M.S. (Plate) |
| 28 | HEX. HD. CAP SCREW WITH WASHER | 02 | M.S. (IS-1367, Gr.-4.6) |
| 27 | BRG. LOCK WASHER | 01 | STEEL |
| 26 | BRG. LOCK NUT | 01 | STEEL |
| 25 | KEY FOR COUPLING | 01 | EN-8 |
| 24 | PUMP SHAFT | 01 | ASTM A 276 S.S.-316 |
| 23 | BEARING SPACER (INNER) | 01 | STEEL |
| 22 | HEX. HD. CAP SCREW | 08 | M.S. (IS-1367, Gr.-4.6) |
| 21 | BEARING COVER | 01 | C.I. (IS-210, FG-260) |
| 20 | BEARING SPACER (OUTER) | 01 | STEEL |
| 19 | FRAME/BEARING HOUSING | 01 | C.I. (IS-210, FG-260) |
| 18 | PIPE PLUG | 02 | M.I. |
| 17 | ANTI FRICTION BEARING (N.D.E.) (6310 Z-C3) | 02 | BRG. STEEL (SKF/FAG Make) |
| 16 | BEARING COVER | 01 | C.I. (IS-210, FG-260) |
| 15 | SEAL COVER/HOUSING | 01 | ASTM A 743, S.S.-CF 8 |
| 14 | SHAFT SLEEVE | 01 | ASTM A276 S.S.-316 |
| 13 | STUFFING BOX BUSH | 01 | BRONZE (IS-318, LTB-II) |
| 12 | SEALING LINE (Out Let & Inlet) | 02 | S.S FLEXIBLE BRIDED PIPE |
| 11 | O RING | 01 | NITRILE RUBBER |
| 10 | MECH. SEAL ASSY. | 01 | Faces Carbon vis Si. C. |
| 09 | BACK COVER/BACK HEAD | 01 | 2% Ni. C.I. (IS-210, FG-260) |
| 08 | WEARING RING CASING (Back Side) | 01 | BRONZE (IS:318, LTB-II) |
| 07 | PIPE PLUG | 02 | M.I. |
| 06 | KEY FOR IMPELLER | 01 | EN-8 |
| 05 | IMPELLER NUT | 01 | BRONZE (IS:318, LTB-II) |
| 04 | IMPELLER | 01 | STEEL |
| 03 | WEARING RING CASING (Front Side) | 01 | BRONZE (IS:318, LTB-II) |
| 02 | DOWEL PIN | 04 | En-8/En-9 |
| 01 | CASING (VOLUTE) | 01 | 2% Ni. C.I. (IS-210, FG-260) |

FLOWMORE
NEW DELHI

JOB NAME :- WATER PUMP

CLIENT

PROJECT :- A/c. N.T.P.C.-KORBA

P.O. NO. :- 22A-1477 TITLE: CROSS SECTIONAL DRAWING FOR HORIZONTAL END SUCTION PUMP

DATE: 04.10.2021

SCALE: N.T.S.

SHEET 1 OF 1

DRAWING NO. CSD-SALE21105325 10

SIZE: A4

| FIG. | SIZE | STAGE | LUB. |
|--------|-----------------|--------|--------|
| F 5625 | 125x100 (5"x4") | SINGLE | GREASE |

| Rev.No | REVISION | SIGN | DATE |
|--------|-----------------|-------|------------|
| 1 | CHANGE AS MARKS | BALAM | 11.02.2023 |

| PUMP PARTICULARS (QTY.:- 02 Nos.) |
|-----------------------------------|
| FIG. -- F 5625 |
| SIZE -- 125x100 (5"x4") |
| STAGE -- SINGLE |
| LUB. -- GREASE |

**KORBA FGD
HVAC SYSTEM**

**COMPLIANCE SHEET ONPG TEST PROCEDURE FOR A/C & VENTILATION SYSTEM FOR FGD CONTROL ROOM
DOC NO. BHEL - PE-V0-466-(571-13000-A)-404, NTPC - 2100-109-PVM-W-005D, R02**

| SI No. | NTPC LIMITED COMMENTS ON RO | BHEL / REPLY | NTPC LIMITED REPLY | SI No. | NTPC LIMITED COMMENTS ON R1 | BHEL / REPLY | NTPC LIMITED REPLY |
|--------|--|---|--------------------|--------|---|---|--------------------|
| 1 | Functional Guarantee Chapter to be attached with Procedure | Noted and enclosed with the revised document. | | 1 | Functional Guarantee as per Bid Declaration to be attached with Procedure | Noted and enclosed with the revised document. | |

| S. No. Guaranteed Parameters | Guaranteed Figures |
|------------------------------|--------------------|
|------------------------------|--------------------|

A minimum of 6 points around each equipment shall be covered for measurement. additional measurement points shall be considered based on the applicable standards and the size of the equipment. the measurement shall be done with slow response on the a - weighting scale. the average of a-weighted sound pressure level measurements expressed in decibels to a reference of 0.0002 micro bar shall not exceed the guaranteed value. corrections for background noise shall be considered in line with the applicable standards. all the necessary data for determining these corrections, in line with the applicable standards, shall be collected during the tests.

(XI) **Mist Outlet Droplet Content(mg/Nm³)**
(Ref. Clause 4.02.00(xi),
Sub-Section-VI, Part-A, Section-VI)

≤ 20 mg/Nm³

(XII) **Availability of FGD Plant**

(Ref. Clause 4.02.00(xii),
Sub-Section-VI, Part-A, Section-VI)

98 %

(XIII) **Air Conditioning System**

(Ref. Clause 4.02.00(xiii),
Sub-Section-VI, Part-A, Section-VI)

As per specification

(XIV) **Ventilation System**

(Ref. Clause 4.02.00(xiv),
Sub-Section-VI, Part-A, Section-VI)

As per specification

(XV) **Compressed Air System**

(Ref. Clause 4.02.00(xv),
Sub-Section-VI, Part-A, Section-VI)

As per specification

(XVI) **Equipment cooling water System**

(Ref. Clause 4.02.00(xvi),
Sub-Section-VI, Part-A, Section-VI)

As per specification

(XVII) **Limestone Handling System and Gypsum Handling System**

(Ref. Clause 4.02.00 (xvii),
Sub-Section-VI, Part-A, Section-VI)

As per specification

Date :

(Designation).....

Place :

(Printed Name).....






(xi) Mist Outlet Droplet Content

The mist eliminator outlet droplet content shall be guaranteed to be ≤ 20 mg/Nm³ at absorber outlet measured over a period of 24 hrs continuous operation.

Mist outlet-droplet content shall be measured as per applicable clauses in VDI Norm 3679 and the Contractor shall carry out the tests as per the test procedure approved by the Employer.

(xii) Availability of FGD Plant

The Contractor shall guarantee the maximum availability of FGD Plant for the range of coal and limestone specified inline with the requirements stipulated in clause 7.00.00 of this Sub-Section

(xiii) Air Conditioning System

A. Following shall be demonstrated at Shop

- 1) Capacity and static pressure of AHU fans at its rated duty point.

B. Following shall be demonstrated at Site

- 1) Capacity (TR) of air cooled condensing units (D-X type) for A/C system of FGD control room building.
- 2) Guaranteed room conditions during summer for all the Air conditioned areas.
- 3) Vibration and noise level of condensing units & centrifugal fans of AHUs.

(xiv) Ventilation System

A. Following shall be demonstrated at Shop

- 1) Capacity and discharge pressure of pumps of UAF units at its rated duty point of Ventilation system.
- 2) Capacity and static pressure of UAF fans at its rated duty point of Ventilation system.

B. Following shall be demonstrated at Site

- 1) Vibration & Noise level of centrifugal fans & pumps of UAF units.

(xv) Compressed Air System

a) Following shall be demonstrated at shop:

- i) Capacity and discharge pressure of each air compressor.

b) Following shall be demonstrated at site:

- ii) Dew point of air at the outlet of air drying plants of air compressor.

| CLAUSE NO. | FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES | | |  |
|--|--|--|----------------------|--|
| 6.00.00 | <p>xxvii) Air Conditioning System (*)</p> <p>Total Power consumption at motor input terminals of working units (i.e. excluding stand-by) at its rated duty point of compressor and condenser fans of air cooled condensing unit, Air handling unit (AHU) fans for the Air conditioning system of FGD Control Room Building divided by total nos. of units in respective project..</p> <p>xxviii) Total power consumption at motor input terminal at rated duty of fan of UAF divided by total nos. of units in respective project. (*)</p> <p>((*) Above guaranteed power consumption values shall be at 20 deg C for centrifugal fans of AHUs and at 30 deg C for centrifugal fans of UAF units and at an elevation of RL (referring to GLP of respective projects) for both AHUs and UAF centrifugal fans.)</p> | | | |
| | <p>xxix) Total power consumption at motor input terminal at rated duty of Air compressor, Air drying plant (Heater and blower, as applicable) divided by total nos. of units in respective project</p> <p>NOTE:</p> <ol style="list-style-type: none"> 1. The equipment's listed above for calculating auxiliary power consumption are indicative. Any other equipment required for continuous operation of the system shall also be considered for calculation of auxiliary power consumption. Power consumption of all equipments provided on unitized basis shall be included in the unit auxiliary power consumption. For common station auxiliaries, the power consumption shall be assigned to each unit based on unit load for the purpose of calculating the unit auxiliary power consumption. 2. The bidder shall furnish a list of equipments to be covered under auxiliary power consumption, which shall be subject to Employer's approval. 3. Transformer losses (TL) shall be considered as per following (as applicable)- Aux/LT Outdoor/ LT Indoor Transformer: 100 % No load loss and 25 % of Copper Losses. 4. Auxiliary power shall be measured without SCR (De-NOx) system. 5. Auxiliary power shall be measured at the switchgear of the drives. <p>METHOD OF COMPUTING TEST EFFICIENCY OF FGD</p> <p>The performance tests shall be carried out in accordance with ASME PTC 40 (1991) code. No tolerance or allowance on the test result will be permitted for instrument errors or inaccuracy, the method of testing or any other causes. The details of the</p> | | | |
| <p>LOT-3 PROJECTS FLUE GAS DESULPHURISATION (FGD) SYSTEM PACKAGE</p> | <p>TECHNICAL SPECIFICATION SECTION – VI, PART-A BID DOC. NO.:CS-0011-109(3)-9</p> | <p>SUB-SECTION-VI FUNCTIONAL GUARANTEES & LIQUIDATED DAMAGES</p> | <p>PAGE 28 OF 30</p> | |

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
| Package | HVAC FOR FGD | |
| Document Title | PG Test Procedure for AC & Ventilation System | |
| OWNER | NTPC Limited | |
| EPC Contractor | Bharat Heavy Electrical Limited | |
| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
| CONTRACTOR | | |

1.0.0 INTRODUCTION

In accordance with the condition of contract / letter of award on successful completion of system trial operation at site and liquidation of all defects, the system / individual equipments shall be subjected to performance and Guarantee Tests at site.

2.0.0 SCOPE

The test procedure shall cover the Performance and Guarantee Tests to be conducted at site for the entire system / sub systems and individual equipments covered in the Air-conditioning & Ventilation System as specified. The test procedure shall cover the testing method for parameters covered as "Guaranteed Parameters" in LOA and checking of ratings and performance requirements stipulated for various equipments covered in the specifications.

3.0.0 OBJECTIVE OF THE TEST

- 3.1.0 To check healthy working of all the equipments forming the total air conditioning and ventilation system.
- 3.2.0 To check the power consumption of the motors for which power consumption limits are guaranteed at specified capacity of equipments.
- 3.3.0 To verify the total capacity of the plant including stand-by equipments. The tonnage rating (capacity) obtained from all AHUs. However, capacity of plant shall be verified during summer but room temperature verification for 24 hours shall be done in both summer and monsoon.
- 3.4.0 Capacity rating and guaranteed power consumption to be established during summer only during May to August, when the ambient temperature (DBT) is generally high and humid.
- 3.5.0 To check the temperature and relative humidity conditions during summer and monsoon in the air-conditioned space with those incorporated in the contract.
- 3.6.0 Operating parameters of the system to be logged for complete cycle with calibrated instruments at the time of capacity test.
- 3.7.0 Operating parameters of the system may be logged with online instruments except calibrated psychrometer for Room condition test during Monsoon test.
- 3.8.0 To check satisfactory operation of all safety switches and electrical interlocks for each individual equipment and for the complete system.
- 3.9.0 Vibration and noise level to be measured for all rotating equipments.

| | | |
|----------------|---|---------|
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| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
| CONTRACTOR | | |

4.0.0 CONDITION OF TEST

4.1.0 CONDUCTANCE OF TEST

Performance and Guarantee Test at site shall be conducted by accredited representatives of the Vendor, BHEL/ NTPC. The contractor shall be given permission to inspect the entire system in advance and make it ready for test. Vendor's representative's witness and associate with all phases of the test and record the data jointly with BHEL/NTPC representatives.

4.1.1 The responsibility for conducting the test rests with the vendor.

4.1.2 Necessary power supply to all the equipments (as required by system) as per scope shall be provided by BHEL/NTPC.

4.2.0 TEST INSTRUMENTS

4.2.1 All instruments required for the PG Test will be provided by the Vendor.

4.2.2 Calibration of test instruments shall be responsibility of the vendor

4.2.3 Calibration of instruments (to be used in the test) shall be carried out at a Govt. / NTPC/BHEL approved test laboratory/NABL approved Laboratory.

4.2.4 Calibration of the instruments should be carried out prior to, but not more than six months before the commencement of the test. The calibration certificate of the instruments should be valid for the period of the test.

4.2.5 Calibration certificates (in original) of all instruments from Govt. /NTPC/BHEL approved Test Laboratory shall be submitted by the vendor for NTPC approval prior to start of the test. Original Calibration certificate will be returned to vendor after review & acceptance of the certificate.

4.2.6 All the calibrated instruments preferably shall be sealed after calibration at Test Lab & intactness of the seal shall be checked by NTPC/BHEL before start of the test. NTPC/BHEL shall issue a certificate confirming the breakage of the seal after verification of instruments.

4.2.7 On line pressure gauges shall be used for recording the parameters of compressor cycle.

4.2.8 Calibrated gauges of $\pm 0.5\%$ accuracy shall be used on water circuit for pressure and temperature measurement.

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
| Package | HVAC FOR FGD | |
| Document Title | PG Test Procedure for AC & Ventilation System | |
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| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
| CONTRACTOR | | |

4.2.9 Airflow of AHU shall be measured by using calibrated anemometer /velometer.

4.2.10 Bearing temperature is to be measured with Temperature Gun of ± 1 Deg C accuracy with LC of 0.5 deg C.

4.2.12 Dry and wet bulb temperatures shall be measured using sling psychrometers. The sling psychrometers shall be ± 0.5 % accuracy with LC of 0.5 Deg C.

4.2.13 All power consumption measurements shall be done by 2-wattmeter method OR clamp-on power analyzer. The wattmeter of accuracy class $\pm 1\%$ duly calibrated shall be used.

4.2.14 Tachometer for RPM measurement shall be of $\pm 1.0\%$ accuracy.

4.2.15 Calibrated instruments shall be used for vibration and noise level measurement.

4.3.0 PRE-REQUISITES TO THE P & G TESTS

4.3.1 The contractor should furnish a written statement to the effect that work covered in the contract has been completed for the system for which PG test will be carried out.

4.3.2 All the erection/commissioning protocols in respect of hydro test of pipelines headers, alarm/annunciation/control system, vibration and noise level data of AHU and Condensing Unit during commissioning shall be made available during PG Test by the vendor.

4.3.3 All NTPC approved datasheets for the plant/system for which PG test is to be carried out to be made available during PG Test.

4.3.4 Uninterrupted power supply within specified parameters for the duration of the test to be ensured by NTPC/BHEL.

4.3.5 Proper lubrication and oil level of all equipments to be ensured.

4.3.6 Cleanliness of plant/system shall be ensured by BHEL/NTPC.

4.3.7 Protection relays of switchgears and all motor feeders shall be checked by BHEL/ NTPC.

4.3.8 Readiness of all protections, interlocks and safety switches to be ensured. Joint protocol in this respect shall be signed.

4.3.9 Availability of suitable fire protection systems/firefighting equipments to be ensured By BHEL/NTPC during PG Test.

4.3.10 Deputation of team to site to be associated with the P & G Test to be ensured by the Vendor.

4.3.11 Successful completion of trial operation.

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
| Package | HVAC FOR FGD | |
| Document Title | PG Test Procedure for AC & Ventilation System | |
| OWNER | NTPC Limited | |
| EPC Contractor | Bharat Heavy Electrical Limited | |
| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
| CONTRACTOR | | |

4.3.12 Arrangement of all calibrated test instrument as per Cl. No. 4.2.0 to be ensured by the VENDOR

4.3.13 The plant/system shall be jointly inspected by NTPC/BHEL, Vendor and a joint protocol shall be signed that the plant is fit for P & G Test.

4.4.0 GUARANTEED PARAMETERS DECLARATION

The contractor should furnish a declaration in the manner as per Appendix-I for the guaranteed parameters which attract levy of liquidated damages for shortfall in performance. Also declaration in manner as per Appendix-II shall be given by contractor for other parameter covered as other guaranteed parameter Without liquidity damages.

5.0.0 TEST METHODOLOGY

The test can be classified into two following groups:

Air-conditioning System

1. Equipment performance
2. Capacity Assessment – Verify the plant capacity (tonnage rating), during summer Period May to August when ambient Temperature (DBT) is generally high.
3. Power consumption at specified capacity of equipment.
4. Room condition test during summer and monsoon.

Ventilation System

1. Equipment performance
2. Capacity of Fan and Pump of UAF
3. Power consumption of motor for UAF at specified capacity of the equipment.
4. Saturation Efficiency of UAF

Air-conditioning System

5.1.0 Equipment performance

The plant should run continuously for 2 to 3 hours for stabilization of the system before measurements. After stabilization of the system, various parameters of the major equipment will be recorded in hourly log sheet. Four sets of such readings are to be recorded under stable conditions.

Followings are the parameters to be recorded during equipment performance check

5.1.1 Current rating and voltage of all motors with on line meter or calibrated tong tester to be logged.

5.1.2 Bearing temperature of all motors with calibrated Temperature Gun.

5.1.3 DBT and WBT measurement of leaving air from canvas connection/ after copper Coil of

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
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| CONTRACTOR | | |

AHU shall be measured.

5.1.4 Velocity of air shall be measured on the filters at the suction area of the AHUs with calibrated anemometer/velometer.

5.1.5 After completion of capacity tests, working of heaters and humidifiers shall be demonstrated by adjusting the set points. The instruments controlling these equipments are to be kept in their set points during PG test and shall operate automatically only, if the inside conditions demand for.

5.1.6 Speed of rotating equipment, wherever possible shall be checked with calibrated Tachometer

5.1.7 Noise and vibration level measurement

Vibration and noise level of AHU measured during PG test. Permissible limit of vibration for AHU, shall be in line with VDI 2056 class IV machines (Good Zone) i.e. 4.0mm/sec. Vibration level of Air Cooled Condensing unit shall be as per manufacturer recommendation.

The maximum noise level shall be 85 dbA at 1.5 meter elevation and at a horizontal distance of 1.0 meter from the equipment.

5.1.8 Interlock & Protection need to be checked & recorded in the form of a protocol jointly signed by persons responsible for conductance of PG test.

5.2.0 CAPACITY ASSESSMENT:

Air Cooled Condensing System:

5.2.1 Plant capacity from AHU method

For verifying the plant capacity by AHU method the total air quantity handled by individual AHU shall be measured as mentioned below:

Air quantity measurement will be taken in front of AHU suction in a direction perpendicular to AHU suction area. The air velocity shall be measured with calibrated anemometer/ Velometer. While taking this measurement on filters in front of AHU suction area. The air velocity shall be measured with calibrated anemometer/velometer, the following conditions are to be maintained:

- a. All the AHUs except the standby unit should be in running condition.
- b. Doors leading to AHU room should be kept closed and all other openings in AHU room as well as in the air-conditioned space and the areas in the return air path are to be sealed.

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
| Package | HVAC FOR FGD | |
| Document Title | PG Test Procedure for AC & Ventilation System | |
| OWNER | NTPC Limited | |
| EPC Contractor | Bharat Heavy Electrical Limited | |
| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
| CONTRACTOR | | |

- c. Air quantity of fresh air should be measured and damper is to be adjusted to allow the required quantity of fresh air only.
- d. Air velocity should be measured using calibrated Anemometer/velometer. Velocity shall be taken at 9 transverse points in a direction perpendicular to AHU suction area. Measurements shall be carried out to compute average air flow.

AHU being the ultimate equipment for heat transfer, Capacity of the system shall be arrived at by calculations based on various recorded data of AHU.

It is to be ensured that while recording different parameters of AHU, the rotary compressor shall run at full load.

METHOD OF CALCULATIONS:

$T = Q \times d \times (E1-E2)/3024$
Where,

T = Capacity in TR

Q = Quantity of air in m³/hr

D = Density of air AHU inlet in kg/m³, i.e. 1.2 kg/m³

E1 = Enthalpy of entering air at AHU in Kcal/kg

E2 = Enthalpy of leaving air from AHU in Kcal/kg

Q is to be calculated by multiplying mean velocity of air by inlet suction area of AHU.

E1 & E2 are to be found out by plotting dry and wet bulb temperatures of entering and leaving air on psychrometric chart.

5.3.0 POWER CONSUMPTION TEST:

Measurement of power for all motors shall be done by Power Analyzer OR Two wattmeter method only. Power measurement shall be done at rated capacity during test equipments.

5.4.0 ROOM CONDITION TEST:

Room condition shall consist of taking the readings of dry and wet bulb temperature at different location points to be mutually decided at site in the areas which are air-conditioned by the respective system/plant room condition test shall be done after stabilization of system.

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
| Package | HVAC FOR FGD | |
| Document Title | PG Test Procedure for AC & Ventilation System | |
| OWNER | NTPC Limited | |
| EPC Contractor | Bharat Heavy Electrical Limited | |
| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
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The dry and wet bulb temperature shall be measured by sling psychrometer which will have accuracy of $\pm 0.5\%$ with at least count of 0.5 deg C.

This will be carried out for 24 hours continuously and readings will be taken every two hours. Standby equipment should be changed over during these 24 hours. This test shall be carried out during summer when the maximum ambient temperature is at least 40°C and during when relative humidity prevalent is not less than **(-) 10%** of design value.

Ventilation System

6.1.0 Equipment performance

The plant should run continuously for 2 to 3 hours for stabilization of the system before measurements. After stabilization of the system, various parameters of the major equipment will be recorded in hourly log sheet. Four sets of such readings are to be recorded under stable conditions.

Followings are the parameters to be recorded during equipment performance check

6.1.1 Current rating and voltage of all motors with on line meter or calibrated tong tester to be logged.

6.1.2 Bearing temperature of all motors with calibrated RTD/temp gauge/temp gun.

6.1.3 Velocity of air shall be measured on the filters at the suction area of the UAF with calibrated anemometer/velometer.

6.1.4 Pressure drop across filter to be measured with water filled U tube manometer.

6.1.5 Speed of rotating equipment, wherever possible shall be checked with calibrated Tachometer

6.1.7 Noise and vibration level measurement

Vibration and noise level of UAF Fan and recirculation pump to be measured during PG test. Permissible limit of vibration for pumps shall be 75 microns pk-pk and for UAF Fan , shall be in line with VDI 2056 class X machines (Good Zone) i.e. 6.8mm/sec.

The maximum noise level shall be 85 dbA at 1.5 meter elevation and at a horizontal distance of 1.0 meter from the equipment.

6.1.8 Interlock & Protection need to be checked & recorded in the form of a protocol jointly signed by persons responsible for conductance of PG test.

6.2.0 CAPACITY OF FANS & PUMPS

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
| Package | HVAC FOR FGD | |
| Document Title | PG Test Procedure for AC & Ventilation System | |
| OWNER | NTPC Limited | |
| EPC Contractor | Bharat Heavy Electrical Limited | |
| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
| CONTRACTOR | | |

The air flow quantity shall be calculated by measuring velocity with help of Anemometer in front of intake louver. Velocity shall be measured at 5-7 transverse points across the intake louver of Unitary Air Filtration (UAF) unit to compute average velocity for flow calculations across Unitary Air Filtration Unit. Four sets of such reading shall be recorded.

Fan Capacity in m³/hr = (Average velocity (m/sec) x Inlet suction area (m²) x 3600)
Where,

Inlet suction area = Area of Intake louver in m² of UAF

Capacities of UAF pumps shall be obtained from the characteristic curve of pump and pressure differential across the pump.

6.3.0 POWER CONSUMPTION TEST:

Measurement of power for all motors shall be done by Power Analyzer OR Two wattmeter method only. Power measurement shall be done at rated capacity during test equipments.

6.4.0 UAF Saturation Efficiency.

6.4.1 Saturation Efficiency shall be computed using following formula:-

Saturation Efficiency:

$(T_e - T_i) / (T_e - t_e) > 60\%$, where

T_e = Dry Bulb temperature Entering UAF Unit.

T_i = Dry Bulb temperature Leaving UAF Unit.

t_e = Wet Bulb temperature Entering UAF Unit.

Dry Bulb & Wet Bulb Temperature at Inlet & Outlet of UAF shall be measured by Sling Phychrometer reading will be taken through moving air and continued till reading becomes steady. The forming part of Sling Phychrometer shall be +/- 0.5% deg C.

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
| Package | HVAC FOR FGD | |
| Document Title | PG Test Procedure for AC & Ventilation System | |
| OWNER | NTPC Limited | |
| EPC Contractor | Bharat Heavy Electrical Limited | |
| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
| CONTRACTOR | | |

ANNEXURE-I

AIR CONDITIONING & VENTILATION SYSTEM PACKAGE

Guarantee Declaration

A. Category –I Guarantees

Guaranteed Power Consumption for Air Conditioning System

| SL. No. | Description of Equipment | Technical Parameter at rated duty point | Quantities for working Units | Guaranteed Power Consumption at motor input terminal and control panel (in kW) |
|---------|----------------------------|---|------------------------------|--|
| 1.0 | A/C System | | | |
| 1.1 | Air Cooled Condensing Unit | | | |
| 1.1.1 | Out Door Unit | | | |
| 1.1.2 | AHU Unit | | | |
| 1.1.3 | Ventilation System | | | |
| 2.0 | UAF | | | |
| 2.1 | UAF Fan | | | |
| | Total | | | |

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
| Package | HVAC FOR FGD | |
| Document Title | PG Test Procedure for AC & Ventilation System | |
| OWNER | NTPC Limited | |
| EPC Contractor | Bharat Heavy Electrical Limited | |
| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
| CONTRACTOR | | |

ANNEXURE-II

OTHER GUARANTEED PARAMETERS

| | |
|--------------------------------------|-------------------------------------|
| Design Ambient Temperature (summer) | i) DB – 43.9°C ii) WB – 25.6.0°C |
| Design Ambient Temperature (monsoon) | i) DB – 38.4°C ii) WB – 27.8°C |
| Design Ambient Temperature (winter) | i) DB – 15°C ii) WB – 10°C |

FGD Control Building.

Design Indoor Conditions

DB

RH

FGD Control Room

24°C±1°C

50%±5%

Plant Capacity

- | | |
|------------------|--|
| i) Main AC Plant | 50 TR Air Cooled Condensing Unit (3W+3S) |
|------------------|--|

Pump Capacity

- | | |
|-------------------------------------|--------------------------------------|
| i) Water Recirculation Pump for UAF | 84 m ³ /hr & 30 head (1W) |
|-------------------------------------|--------------------------------------|

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
| Package | HVAC FOR FGD | |
| Document Title | PG Test Procedure for AC & Ventilation System | |
| OWNER | NTPC Limited | |
| EPC Contractor | Bharat Heavy Electrical Limited | |
| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
| CONTRACTOR | | |

| Sr. No. | Equipment | Description of Parameter | Guaranteed Value as per LOA | Quantity (working quantity as per tech. Spec.) | Value noted during PG test |
|----------|---|--|-----------------------------|--|--|
| A | AC Plant for FGD Control Room Building: | | | | |
| 1 | Air Cooled Condensing Unit, 50 TR | Power consumption in KW at motor input terminal at rated duty point for each drive | | | |
| 1.1 | Out Door Unit | Do | | 3 Nos. | |
| 1.2 | AHU | Do | | 3 Nos. | |
| | | | | | |
| B | Ventilation Plant for FGD Control Room Building: | | | | |
| 2 | UAF | | | 2 Nos. | |
| 2.1 | UAF Fan | | | | Shop Test Value to be noted at duty point as per spec of Functional Guarantees hence not need to check during PG test. |

| | | | |
|----------------|---|---------|--|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | | |
| Package | HVAC FOR FGD | | |
| Document Title | PG Test Procedure for AC & Ventilation System | | |
| OWNER | NTPC Limited | | |
| EPC Contractor | Bharat Heavy Electrical Limited | | |
| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 | |
| CONTRACTOR | | | |

| Format for Recording Temperature Parameter Across AHU | | | | | | | | | |
|---|-----------------------|----------------------------|------------|-------------------------|---------|--------------------|------------------------|---------|--------------------|
| Area: | | Instrument Used & Sr. No.: | | | | | | | |
| Sr. No. | Unit of Operation | Reading No. | Time / Hrs | Entering Air Parameters | | | Leaving Air Parameters | | |
| | | | | DB (°C) | WB (°C) | Enthalpy (kcal/kg) | DB (°C) | WB (°C) | Enthalpy (kcal/kg) |
| 1 | Air Handling Unit No. | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 2 | Air Handling Unit No. | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 3 | Air Handling Unit No. | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 4 | Air Handling Unit No. | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 5 | Air Handling Unit No. | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 6 | Air Handling Unit No. | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| NTPC | | BHEL | | | AVPL | | | | |

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
| Package | HVAC FOR FGD | |
| Document Title | PG Test Procedure for AC & Ventilation System | |
| OWNER | NTPC Limited | |
| EPC Contractor | Bharat Heavy Electrical Limited | |
| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
| CONTRACTOR | | |

| Format for Recording Vibration Level & Noise Level of Equipment | | | | | | | | | |
|---|-----------|-------------|------|-------------------------|---|----------------|--------------------|-----|---------|
| Area: | | | | | | Appendix - III | | | |
| Instrument Used & Sr. No.: | | | | Reading Set No. | | | | | |
| Sr. No. | Equipment | Reading No. | Time | Displacement in Microns | | | Noise Level In dBA | RPM | Remarks |
| | | | | V | H | A | | | |
| 1 | AHU No. : | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 2 | AHU No. : | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 3 | AHU No. : | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 4 | AHU No. : | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 5 | AHU No. : | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 6 | AHU No. : | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| NTPC | | | BHEL | | | AVPL | | | |

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
| Package | HVAC FOR FGD | |
| Document Title | PG Test Procedure for AC & Ventilation System | |
| OWNER | NTPC Limited | |
| EPC Contractor | Bharat Heavy Electrical Limited | |
| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
| CONTRACTOR | | |

| Format for Recording Bearing Temperature Deg. C of Equipment | | | | | | |
|--|------------|-------------|---|-----------|---------------|---------|
| Project: | | | Package: | | | |
| Area: | | | Contractor: Advance Ventilation Pvt. Ltd. | | | |
| Instrument Used & Sr. No.: | | | COA No.: | | | |
| Reading Set: | | | Unit of Operation: | | Date: | |
| Document No. | | | Rev. -00 | | | |
| Sr. No. | Equipment | Reading No. | Time | Drive END | Non Drive END | Remarks |
| 1 | FAN NO. : | 1 | | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| | | 4 | | | | |
| 2 | FAN NO. : | 1 | | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| | | 4 | | | | |
| 3 | FAN NO. : | 1 | | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| | | 4 | | | | |
| 4 | FAN NO. : | 1 | | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| | | 4 | | | | |
| 5 | FAN NO. : | 1 | | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| | | 4 | | | | |
| 6 | PUMP NO. : | 1 | | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| | | 4 | | | | |
| 7 | PUMP NO. : | 1 | | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| | | 4 | | | | |
| 8 | PUMP NO. : | 1 | | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| | | 4 | | | | |
| 9 | PUMP NO. : | 1 | | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| | | 4 | | | | |
| 10 | PUMP NO. : | 1 | | | | |
| | | 2 | | | | |
| | | 3 | | | | |
| | | 4 | | | | |
| | | | | | | |
| | AVPL | | BHEL | | NTPC | |

| | | |
|----------------|---|---------|
| Project | 3X200+3X500+1x500 MW NTPC KORBA TPP-FGD | |
| Package | HVAC FOR FGD | |
| Document Title | PG Test Procedure for AC & Ventilation System | |
| OWNER | NTPC Limited | |
| EPC Contractor | Bharat Heavy Electrical Limited | |
| Document No. | PE-V0-466-(571-13000-A)-A404 | Rev.:02 |
| CONTRACTOR | | |

| Format for Recording Vibration Level & Noise Level of Equipment | | | | | | | | | |
|---|-----------|-------------|------|---|---|-------|--------------------|-----|---------|
| Project: | | | | Package: | | | | | |
| Area: | | | | Contractor: Advance Ventilation Pvt. Ltd. | | | | | |
| Instrument Used & Sr. No.: | | | | COA No.: | | | | | |
| Reading Set: | | | | Unit of Operation: | | Date: | | | |
| Document No. | | | | Rev. - | | | | | |
| Sr. No. | Equipment | Reading No. | Time | Displacement in Microns | | | Noise Level In dBA | RPM | Remarks |
| | | | | V | H | A | | | |
| 1 | FAN NO. : | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 2 | FAN NO. : | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 3 | FAN NO. : | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 4 | FAN NO. : | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| 5 | FAN NO. : | 1 | | | | | | | |
| | | 2 | | | | | | | |
| | | 3 | | | | | | | |
| | | 4 | | | | | | | |
| NTPC | | | | BHEL | | | AVPL | | |

**3X200+3X500+1x500 MW NTPC KORBA TPP-FGD
HVAC SYSTEM**

**COMPLIANCE SHEET ON TECHNICAL DATA SHEET & G.A. DRWG. FOR CAST IRON VALVES(GATE VALVE,CHECK VALVE, GLOBE
VALVE) OF VENTILATION SYSTEM**

DOC NO. BHEL -PE-V0-466-(571-13000-A)-A206, NTPC - 2100-109-PVM-Y-002D, R01

| SI No. | NTPC LIMITED COMMENTS ON R0 | BHEL / REPLY | NTPC LIMITED REPLY |
|---------------|---|---|---------------------------|
| 1 | M/s BHEL to ensure Make as per NTPC-QA approved. | As per agreement with NTPC, Vendors for HVAC System shall be BHEL approved sources. Makes used for the valves are as per BHEL approved sources. Kindly approved the document. | |
| 2 | Gun Metal construction for sizes less than 65NB shall be as per IS:778. | Noted and incorporated. | |

SUMMARY -ANNEXURE-I

| S.NO. | ITEM | SIZE | QTY |
|-------|-------------|--------|---------|
| 1 | NRV | 125 NB | 1 No. |
| 2 | Gate Valve | 150 NB | 03 Nos. |
| 3 | Gate Valve | 50 NB | 05 Nos. |
| 4 | Globe Valve | 125 NB | 1 No. |

| | | | |
|----------------------|--|-----------------|------------------------|
| Customer | NTPC | Job No. | M22/DEL-27.BHEL |
| Project | 3X200+3X500+1X500 MW NTPC KORBA TPP | Date | 06.02.2023 |
| BHEL Doc. No. | PE-VO-466-(571-13000-A)-A206 | NTPC No. | 2100-109-PVM-Y-002D |

**TECHNICAL DATA SHEET & G.A. DRWG. FOR CAST
IRON VALVES(GATE VALVE,CHECK VALVE, GLOBE
VALVE) OF VENTILATION SYSTEM**

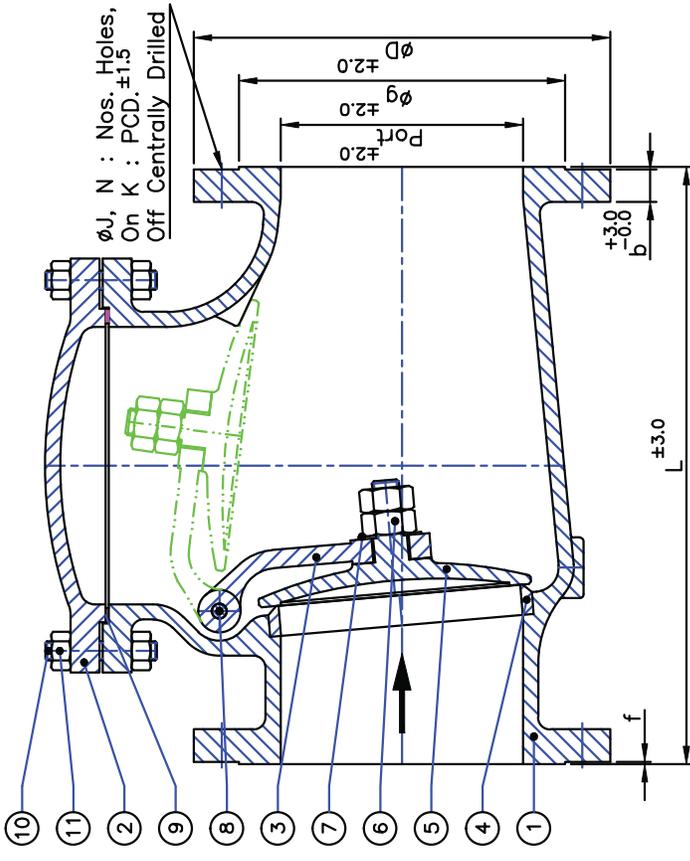
| | | |
|--|--|--|
| HAWA ENGINEERS LTD | |  |
| Plot No. 129 B/h, Kashiram Textile Mill Narol Ahmedabad : 382405 | | |
| SWING CHECK VALVE | | |
| Size & Quantity | | As per Annexure-I |
| End Connection | | FLANGED END TO ASME B 16.5 RF 150# |
| BODY | | ASTM A 216 Gr WCB |
| COVER | | ASTM A 216 Gr WCB |
| HINGE | | ASTM A 216 Gr WCB |
| SEAT RING | | ASTM A 217 Gr CA15 |
| DISC | | ASTM A 217 Gr CA15 |
| DISC RETAINING NUTS | | SS 304 |
| HINGE PIN | | SS 410 |
| COVER GASKET | | GRAPHOIL FILLER SS 304 SPIRAL WOUNDED |
| COVER STUDS | | ASTM A193 Gr B7 |
| COVER NUTS | | ASTM A194 Gr 2H |
| HAWA Brand name | | MARCK |
| Design Standard | | BS 1868 |
| Testing Standard | | API 598 |
| Body Hydro Shell Test Pr(Kg/cm ²) | | 32 |
| Seat Hydro Shell Test Pr(Kg/cm ²) | | 22 |



Technical Data :

Manufacturing Std. : BS 1868
 Face to Face : ASME B16.10
 End Connection : Flanged Ends to ASME B16.5 RF 150#
 Inspection and Testing Std. : API 598

| TEST PRESSURE | | |
|---------------|-----------------------|-----------------------|
| TESTING | BODY | SEAT |
| HYDRAULIC | 32 Kg/Cm ² | 22 Kg/Cm ² |



All dimensions are in M.M.

| | | | |
|---------------|-------|-------|-------|
| SIZE | 125 | 150 | 200 |
| Port | 127 | 152 | 203 |
| L (F to F-RF) | 330 | 356 | 495 |
| øD | 254 | 279 | 343 |
| b | 22.5 | 23.9 | 26.9 |
| øg | 185.7 | 215.9 | 269.7 |
| f | 1.5 | 1.5 | 1.5 |
| øJ | 22.2 | 22.2 | 22.2 |
| N | 8 | 8 | 8 |
| K:PCD. | 215.9 | 241.3 | 298.4 |
| QTY. | 01 | 01 | 01 |

| P. No. | Qty. | Nomenclature | Material |
|--------|------|---------------------|---------------------------------------|
| 11 | Req. | COVER NUTS | ASTM A194 Gr. 2H |
| 10 | Req. | COVER STUDS | ASTM A193 Gr. B7 |
| 9 | 1 | COVER GASKET | GRAPHOIL FILLER SS 304 SPIRAL WOUNDED |
| 8 | 1 | HINGE PIN | SS 410 |
| 7 | 1 | DISC WASHER | SS 304 |
| 6 | Req. | DISC RETAINING NUTS | SS 304 |
| 5 | 1 | DISC | ASTM A216 Gr. WCB+FACING(ER410) |
| 4 | 1 | SEAT RING | ASTM A217 Gr. CA15 |
| 3 | 1 | HINGE | ASTM A216 Gr. WCB |
| 2 | 1 | COVER | ASTM A216 Gr. WCB |
| 1 | 1 | BODY | ASTM A216 Gr. WCB |

| DRAWN BY | | Ravi Patel | |
|----------|---|--------------------------|--|
| CHK. BY | | | |
| APPD. BY | | | |
| DATE | 28/09/21 <th>TITLE</th> <td>ASSEMBLY OF 150# FLANGED ENDS SWING CHECK VALVE.</td> | TITLE | ASSEMBLY OF 150# FLANGED ENDS SWING CHECK VALVE. |
| SCALE | N. T. S. | | |
| CLIENT | | Hawa Engineers Ltd. | |
| | | AHMEDABAD | |
| | | AN ISO 9001 COMPANY | |
| | | DRG. NO. HEL/SWC/150#/D3 | |

| | | | |
|----------------------|--|-----------------|------------------------|
| Customer | NTPC | Job No. | M22/DEL-27.BHEL |
| Project | 3X200+3X500+1X500 MW NTPC KORBA TPP | Date | 06.02.2023 |
| BHEL Doc. No. | PE-VO-466-(571-13000-A)-A206 | NTPC No. | 2100-109-PVM-Y-002D |

HAWA ENGINEERS LTD

Plot No. 129 B/h, Kashiram Textile Mill Narol Ahmedabad : 382405



GATE VALVE DATA SHEET

| | |
|---|-----------------------------------|
| Size | As per Annexure-I |
| End Connection | FLANGED TO ASME B 16.5 RF 150# |
| Body | ASTM A 216 Gr WCB |
| Bonnet | ASTM A 216 Gr WCB |
| WEDGE | ASTM A217 Gr CA15 |
| STEM | ASTM A276 - T410 |
| Seat ring | ASTM A217 Gr CA15 |
| Back seat | OVERLAY |
| Gland | ASTM A276 - T410 |
| Gland flange | ASTM A 216 Gr WCB |
| Bonnet Gasket | SPW SS 304 |
| Bonnet Stud & Nut | ASTM A193 Gr B7 / ASTM A194 Gr 2H |
| Valve make | MARCK |
| Hand Wheel | Malleable Iron |
| MFG STD | API 600 |
| Testing Standard | API 598 |
| Body Hydro Shell Test Pr(Kg/cm ²) | 32 |
| Seat Hydro Shell Test Pr(Kg/cm ²) | 22 |

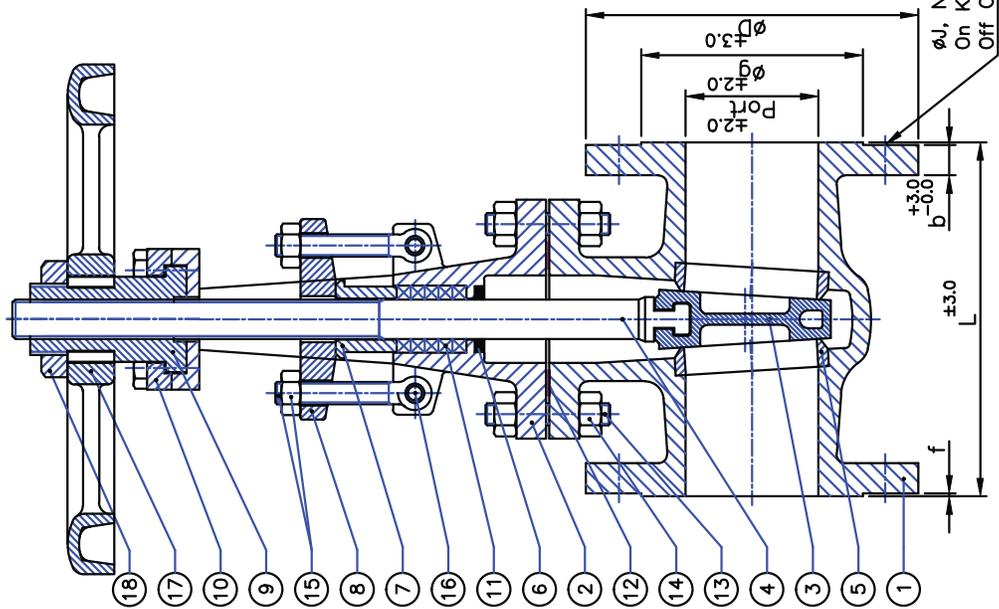


(WE RESERVE THE RIGHT TO CHANGE DESIGN AND TECHNICAL DATA FURNISHED HERE DUE TO CONTINUOUS PRODUCT DEVELOPMENT)

Technical Data :

Manufacturing Std. : API 600
 Face to Face : ASME B16.10
 End Connection : Flanged Ends to ASME B16.5 RF 150#
 Inspection and Testing Std. : API 598

| TEST PRESSURE | | |
|---------------|-----------------------|-----------------------|
| TESTING | BODY | SEAT |
| HYDRAULIC | 32 Kg/Cm ² | 22 Kg/Cm ² |



All dimensions are in M.M.

| | | | | | | |
|-------------------|-------|-------|-------|-------|-------|-------|
| SIZE | 50 | 65 | 80 | 100 | 125 | 150 |
| Port | 51 | 64 | 76 | 102 | 127 | 152 |
| L Face to Face-RF | 178 | 190 | 203 | 229 | 254 | 267 |
| ØD | 150 | 180 | 190 | 230 | 255 | 280 |
| b | 14.3 | 15.9 | 17.5 | 22.3 | 22.3 | 23.9 |
| Øg | 92.1 | 104.8 | 127 | 157.2 | 185.7 | 215.9 |
| f | 2 | 2 | 2 | 2 | 2 | 2 |
| ØJ | 19.05 | 19.05 | 19.05 | 19.05 | 22.2 | 22.2 |
| N | 4 | 4 | 4 | 8 | 8 | 8 |
| K:PCD. | 120.7 | 139.7 | 152.4 | 190.5 | 215.9 | 241.3 |
| QTY. | 0 5 | 0 1 | 0 1 | 0 1 | 0 1 | 0 3 |

| P.No. | Qty. | Nomenclature | Material |
|-------|-------|------------------------|-------------------------------------|
| 18 | 1 | HANDWHEEL NUT | CARBON STEEL |
| 17 | 1 | HANDWHEEL | MALLEABLE IRON/C.I. |
| 16 | 2-2 | GLAND LUG BOLTS & NUTS | CARBON STEEL |
| 15 | 2-2 | GLAND EYEBOLTS & NUTS | CARBON STEEL |
| 14 | Req. | BONNET NUTS | ASTM A194 Gr. 2H |
| 13 | Req. | BONNET STUDS | ASTM A193 Gr. B7 |
| 12 | 1 | BONNET GASKET | GRAPHOIL FILLER SS 304 SPIRAL WOUND |
| 11 | 5min. | STEM PACKINGS | GRAPHOIL |
| 10 | 1 | SLEEVE RETAINER | CARBON STEEL |
| 9 | 1 | YOKE SLEEVE | S.G. IRON (ASTM A395) |
| 8 | 1 | GLAND FLANGE | ASTM A216 Gr. WCB |
| 7 | 1 | GLAND | ASTM A276-T410 |
| 6 | 1 | BACKSEAT | OVERLAY |
| 5 | 2 | SEAT RINGS | ASTM A217 Gr. CA15 |
| 4 | 1 | STEM | ASTM A276-T410 |
| 3 | 1 | WEDGE | ASTM A217 Gr. CA15 |
| 2 | 1 | BONNET | ASTM A216 Gr. WCB |
| 1 | 1 | BODY | ASTM A216 Gr. WCB |

| | |
|----------|----------|
| DRAWN BY | IRFAN |
| CHK. BY | |
| APPD. BY | |
| DATE | 17/12/18 |
| SCALE | N. T. S. |

Hawa Engineers Ltd.
 AHMEDABAD
 ASSEMBLY OF 'OS' & 'Y' TYPE 150#
 FLANGED ENDS GATE VALVE.

Marck
 Industrial Valves
 AN ISO 9001 COMPANY
 DRG. NO. HEL/GT/150#/D1

| | |
|--------------------|------|
| CLIENT | |
| AMENDMENT/REVISION | NAME |
| DATE | NO. |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|



HAWA ENGINEERS LTD

Plot No. 129 B/h, Kashiram Textile Mill Narol Ahmedabad : 382405

GUN METAL GATE VALVE DATA SHEET

| | |
|--------------------------|--|
| Size | 50MM |
| End Connection | FLANGED ENDS TO IS 778, BUT DRILLING AS PER ASME B 16.5 150# |
| Body | GUN METAL |
| Bonnet | GUN METAL |
| Wedge | GUN METAL |
| Stem | H.T.BRASS / FORGED BRASS |
| BACK SEAT | GUN METAL |
| GLAND | GUN METAL |
| GLAND NUT | GUN METAL |
| GLAND PACKING | ASBESTOS |
| HAND WHEEL | C.I. |
| HAND WHEEL NUT & WAHSER | CARBON STEEL |
| Design Standard | IS 778 |
| Body Hydro Shell Test Pr | 1.5 MPA |
| Seat Hydro Shell Test Pr | 1.0 MPA |



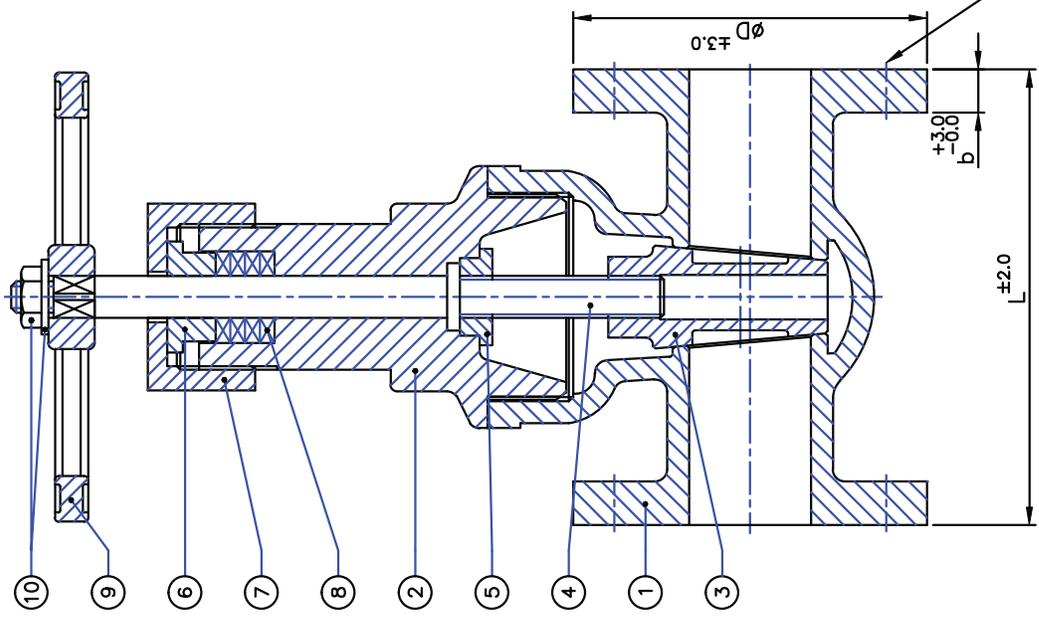
8 7 6 5 4 3 2 1

Technical Data :

Manufacturing Std. : IS 778 Class-1 (PN 1.0)
 End Connections : Flanged Ends to IS 778, But Drilling As Per ASME B16.5 150#

(WE RESERVE THE RIGHT TO CHANGE DESIGN AND TECHNICAL DATA FURNISHED HERE DUE TO CONTINUOUS PRODUCT DEVELOPMENT)

| HYDROSTATIC TEST PRESSURE | |
|---------------------------|-------------------|
| PN - RATING | BODY SEAT |
| 1.0 MPa. | 1.5 MPa. 1.0 MPa. |



All dimensions are in M.M.

| | |
|--------|-------|
| SIZE | 50 |
| L | 120 |
| ØD | 165 |
| b | 11 |
| ØJ | 19.05 |
| N | 4 |
| K:PCD. | 120.6 |
| QTY. | 01 |

05

| P. No. | Qty. | Nomenclature | Material |
|--------|-------|-------------------------|-------------------------|
| 10 | 1-1 | Hand wheel Nut & Washer | Carbon steel |
| 9 | 1 | Hand wheel | C.I. |
| 8 | Reqd. | Gland packings | Asbestos |
| 7 | 1 | Gland nut | Gun metal |
| 6 | 1 | Gland | Gun metal |
| 5 | 1 | Back seat | Gun metal |
| 4 | 1 | Stem | H.T. Brass/Forged Brass |
| 3 | 1 | Wedge | Gun metal |
| 2 | 1 | Bonnet | Gun metal |
| 1 | 1 | Body | Gun metal |

ØJ, N : Nos. Holes,
 On K : PCD. ±1.5
 Off Centrally Drilled

| | | | |
|--------------------|----------|---------------------|------------------------------------|
| DRAWN BY | | SABI | |
| CHK. BY | | | |
| APPD. BY | | | |
| DATE | 02/02/23 | TITLE | ASSEMBLY OF FLANGED ENDS |
| SCALE | N. T. S. | | NON-RISING STEM GATE VALVE CLASS-1 |
| AMENDMENT/REVISION | | NAME | |
| 1 | | | |
| CLIENT | | | |
| | | | |
| AHMEDABAD | | | |
| GA DRG. NO. | | HEL/GT/NRS/CL1/FE/D | |



AN ISO 9001 COMPANY

F 8

| | | | |
|----------------------|---|-----------------|------------------------|
| Customer | NTPC | Job No. | M22/DEL-27.BHEL |
| Project | 3X200+3X500+1X500MW NTPC KORBA TPP | Date | 06.02.2023 |
| BHEL Doc. No. | PE-VO-466-(571-13000-A)-A206 | NTPC No. | 2100-109-PVM-Y-002D |

| | | |
|--|--------------------------------|--|
| HAWA ENGINEERS LTD | |  |
| Plot No. 129 B/h, Kashiram Textile Mill Narol Ahmedabad : 382405 | | |
| GLOBE VALVE DATA SHEET | | |
| | | |
| Size | As per Annexure-I | |
| | | |
| | | |
| End Connection | FLANGED TO ASME B 16.5 RF 150# | |
| | | |
| Body | ASTM A 216 Gr WCB | |
| Bonnet | ASTM A 216 Gr WCB | |
| WEDGE | ASTM A217 Gr CA15 | |
| STEM | ASTM A276 - T410 | |
| Seat ring | ASTM A217 Gr CA15 | |
| | | |
| Back seat | OVERLAY | |
| Gland | ASTM A276 - T410 | |
| Gland flange | ASTM A 216 Gr WCB | |
| | | |
| Bonnet Gasket | SPW SS 304 | |
| Bonnet Stud & Nut | B7 / 2H | |
| Valve make | MARCK | |
| Hand Wheel | Malleable Iron | |
| | | |
| | | |
| MFG STD | API 600 | |
| Testing Standard | API 598 | |
| Body Hydro Shell Test Pr(Kg/cm ²) | 32 | |
| Seat Hydro Shell Test Pr(Kg/cm ²) | 22 | |



| PROJECT : 3X200+4X500 MW NTPC KORBA TPS (FGD SYSTEM PACKAGE) | | | | | | | | | | | | | | | | | | | | |
|--|--|------------------|----------------|------------------|-----------------------------|------------------------|----------------|---------------|-----------------------|-----------------------|-------------------------------------|---------------------------------------|---------------------------------|------------------------------------|---------------------------------------|---|-----------------------------------|------------------------------------|--------------------------------|--|
| OWNER : NTPC LIMITED | | | | | | | | | | EPC Contractor : BHEL | | | | | | | | | | |
| SUMMARY SHEET FOR BUILDING SERVED THROUGH SPLIT AIR CONDITIONERS | | | | | | | | | | | | | | | | | | | | |
| Date: 14.01.2023 | | | | | | | | | | | | | | | | | | | | |
| Rev.: 0 | | | | | | | | | | | | | | | | | | | | |
| S.no | Area Description | Floor Area(sqft) | Equip. Load(W) | Occup. (Persons) | Room Design Temp. in deg. F | Room Design RH in %age | Fresh air ACPH | Fresh air CFM | Dehumidified Unit CFM | Unit Ref. Load (TR) | Unit Ref. Load (TR) with 10% Margin | Dehumidified Unit CFM with 10% margin | Machine Capcty (In TR) Selected | Machine Flowrate (In CFM) Selected | Quantity of Machine required (In Nos) | Quantity of machine as per Flow Rate (In Nos) | No, of machine Selected (Working) | No, of machine Selected (Stand by) | Equipment selection (Split AC) | |
| Machine Details taken from TDS of Split AC Document No. 2100-109-PVM-B-262, PE-V0-466-(571-13000-A)-A213 | | | | | | | | | | | | | | | | | | | | |
| A. | 33 KV SWITCHGEAR ROOM - 2100-109-PVC-B-072 RIO ROOM FOR UNIT NO. 5 ABSORBER | | | | | | | | | | | | | | | | | | | |
| 1 | RIO ROOM, A-B-1-2, 33 KV SWITCHGEAR ROOM | 76.17 | 500 | 1 | 75.2 | 50.0 | NA | 0.00 | 536 | 1.03 | 1.13 | 590 | 1.80 | 555 | 0.63 | 1.06 | 2 | 2 | 2.0 TR (2W +2S) | |
| 2 | A/C AREA - RIO ROOM UNIT 5 ABSORBER | 710.05 | 4400 | 3 | 75.2 | 50.0 | NA | 0.00 | 2510 | 4.77 | 5.25 | 2761 | 1.80 | 555 | 2.92 | 4.97 | 5 | 5 | 2.0 TR (SW +5S) | |



CUSTOMER: NTPC
JOB: 30200-3X500-1-500 MW NTPC KORBA TPP-FGD
SYSTEM: HVAC

JOB No: 466
Doc No: 2100-109-PVM-F-092 / PE-10-466-571-13000-AJ-402
Rev 00

| S No | TITLE | Unit | Length (M) | Width (M) | Height (M) | ACPH | Total Air Required (CMH) | Selected Air Required (CMH) | Type of Fan | FAN SELECTION | | NO. OF FAN | Motor Capacity | Type of Fan | Back draft gravity damper size | | %Age Supply | Quantity | Opening Required |
|------|--|---------|------------|-----------|------------|------|--------------------------|-----------------------------|------------------------|----------------|----------------------|------------|----------------|--|--------------------------------|-------|-------------|----------|------------------|
| | | | | | | | | | | Capacity (CMH) | STATIC PRESSURE (mm) | | | | L (M) | H (M) | | | |
| A | FGD CONTROL ROOM, (ARCHITECTURAL PLANS), 21000-109-PVCB-032A | Station | 3.7 | 3.5 | 3.5 | 30 | 1360 | 2000 | Propeller fan | 1000 | 5 | 2 | 0.1 | Propeller fan, Air Intake through Door Undercut / space between door and floor | | | | | |
| 1 | Toilet, Grid 10-10a-B-A for 4 mtr Switchgear room | Station | 3.7 | 3.5 | 3.5 | 30 | 1360 | 2000 | Propeller fan | 1000 | 5 | 2 | 0.1 | Propeller fan, Air Intake through Door Undercut / space between door and floor | | | | | |
| 2 | Toilet, Grid 10-10a-B-A for 13.6 mtr Switchgear room | Station | 3.7 | 3.5 | 3.5 | 30 | 1360 | 2000 | Propeller fan | 1000 | 5 | 2 | 0.1 | Propeller fan, Air Intake through Door Undercut / space between door and floor | | | | | |
| 3 | Toilet, Grid 10-10a-B-A for 19.2 mtr roof | Station | 3.7 | 3.5 | 3.5 | 30 | 1360 | 2000 | Propeller fan | 1000 | 5 | 2 | 0.1 | Propeller fan, Air Intake through Door Undercut / space between door and floor | | | | | |
| 4 | UPS 24V Battery room, EL 19.2 M, Grid 3-4-A-B | Station | 10.975 | 10.725 | 3.2 | 30 | 11300 | 15000 | Bifurcated Exhaust Fan | 7500 | 15 | 2 | 1.1 | Wall mounted bifurcated axial exhaust fan | 0.8 | 0.7 | 2.5 | 0.6 | 900mmx 800 mm |
| 5 | 220 V Battery room, EL 19.2 M, Grid 1-2-A-B | Station | 10.975 | 7.85 | 3.2 | 30 | 8271 | 15000 | Bifurcated Exhaust Fan | 7500 | 15 | 2 | 1.1 | Wall mounted bifurcated axial exhaust fan | 0.8 | 0.7 | 2.5 | 0.6 | 900mmx 800 mm |
| B | GENERAL ARRANGEMENTS OF LIMESTONE DAY SILOS & WET BALL MILL BUILDING, 2100-109-PVM-B-021, 0-62-411-0001.4 | Station | 6 | 4 | 4 | 30 | 2880 | 4000 | Supply Air Fan | 4000 | 30 | 1 | 0.75 | Wall mounted Supply Air Fan | 0.4 | 0.3 | 6 | 0.6 | 500mmx 400 mm |
| 1 | VFD Room - Gravimetric Feeder | Station | | | | | | 1000 | Propeller fan | 1000 | 5 | 1 | 0.1 | Propeller fan, Air Intake through Door Undercut / space between door and floor | | | | | |
| 2 | Ladies Toilet for the Building | Station | | | | | | 1000 | Propeller fan | 1000 | 5 | 1 | 0.1 | Propeller fan, Air Intake through Door Undercut / space between door and floor | | | | | |
| 3 | Gents Toilet for the Building | Station | | | | | | 1000 | Propeller fan | 1000 | 5 | 1 | 0.1 | Propeller fan, Air Intake through Door Undercut / space between door and floor | | | | | |
| C | GYPSUM DEWATERING BUILDING (ARCHITECTURAL PLANS & FINISHING SCHEDULE), 2100-109-PVC-B-023 (CARRYING COMPRESSOR HOUSE, MCC LIMESTONE STORAGE AT 0.0M OF THE BUILDING) | Station | 11.905 | 11.305 | 9.8 | 20 | 29017 | 30000 | Axial Supply | 10000 | 20 | 3 | 1.5 | Combination of Wall Mounted Supply & Exhaust Fan | | | | | |
| 1 | Compressor House AT 0.0 M at Grid 2-4-A-B | Station | | | | | | 18000 | Axial Exhaust Fan | 10000 | 10 | 2 | 0.75 | Combination of Wall Mounted Supply & Exhaust Fan | | | | | |
| 2 | Switch gear at 0.0M 2-4-B-C | Station | 11.905 | 12.62 | 9.8 | 30 | 48588 | 50000 | Axial Supply | 10000 | 30 | 5 | 2.2 | Wall mounted Supply Air Fan with Gravity Dampers | 1.0 | 0.85 | 2.5 | 0.6 | 1100mmx 950 mm |
| 3 | Limestone Area AT 0.0 M at Grid 9-10-A-B | Station | 7.9 | 7.1 | 4.1 | 20 | 5059 | 6000 | Axial Supply | 6000 | 20 | 1 | 1.1 | Combination of Wall Mounted Supply & Exhaust Fan | | | | | |
| 4 | Belt filter at 10.0M at Grid 1-10-A-B-C | Station | 5.635 | 24.6 | 8.3 | 20 | 253122 | 260000 | Axial Exhaust Fan | 4000 | 10 | 1 | 0.55 | Combination of Wall Mounted Supply & RE Fan | | | | | |
| 5 | Primary hydroclone area at 19.4M | Station | 24.6 | 6.25 | 5.85 | 20 | 19788 | 20000 | Axial Supply | 10000 | 20 | 2 | 1.5 | RE Unit is kept at 19.1M for exhausting air from the building. | | | | | |
| 6 | Ladies Toilet for above Building | Station | | | | | | 12000 | Axial Exhaust Fan | 15000 | 10 | 1 | 1.1 | Combination of Wall Mounted Supply & Exhaust Fan | | | | | |
| 7 | Gents Toilet for above Building | Station | | | | | | 1000 | Propeller fan | 1000 | 5 | 1 | 0.1 | Propeller fan, Air Intake through Door Undercut / space between door and floor | | | | | |
| D | 2100-109-PVC-B-072, 33 KV SWITCHGEAR ROOM ARCH PLAN | Station | 26.185 | 10 | 3.3 | 30 | 25923 | 30000 | Axial Supply | 6000 | 30 | 5 | 1.1 | Wall mounted Axial Supply fan with pre and fine filter | 0.9 | 0.8 | 2.5 | 0.6 | 1000mmx 900 mm |
| 1 | Cable vault grid 1.5-A-B | Station | | | | | | 30000 | Axial Supply | 6000 | 30 | 5 | 1.1 | Wall mounted Axial Supply fan with pre and fine filter | 0.9 | 0.8 | 2.5 | 0.6 | 1000mmx 900 mm |
| 2 | Switchgear grid 1.5-A-B | Station | 26.185 | 10 | 3.8 | 30 | 29851 | 30000 | Axial Supply | 6000 | 30 | 5 | 1.1 | Wall mounted Axial Supply fan with pre and fine filter | 0.9 | 0.8 | 2.5 | 0.6 | 1000mmx 900 mm |
| E | RIO ROOM, UNIT-5 ABSORBER | Station | 4 | 6 | 3.5 | 30 | 2520 | 4000 | Bifurcated Exhaust Fan | 2000 | 15 | 2 | 0.55 | Wall mounted bifurcated axial exhaust fan | 0.6 | 0.5 | 2.5 | 0.6 | 700mmx 600 mm |
| 1 | Battery room for RIO Panels | Station | | | | | | 1000 | Propeller fan | 1000 | 5 | 2 | 0.1 | Propeller fan, Air Intake through Door Undercut / space between door and floor | | | | | |
| 2 | Toilet | Station | | | | | | 1000 | Propeller fan | 1000 | 5 | 2 | 0.1 | Propeller fan, Air Intake through Door Undercut / space between door and floor | | | | | |

NOTES:
 1. FOLLOWING BUILDINGS / AREAS OF THE BUILDINGS ARE OPEN TYPE & DOES NOT HAVE ANY WALL. ACCORDINGLY, VENTILATION SYSTEM IS NOT APPLICABLE.
 A) GA & PIPING LAYOUT IN & AROUND ACW / ECW PUMP SHED FOR FGD, 2100-109-PVM-F-048, PE-DG-466-181-M001 - SHED
 B) GYPSUM DEWATERING BUILDING (ARCHITECTURAL PLANS & FINISHING SCHEDULE), 2100-109-PVC-B-023 (CARRYING COMPRESSOR HOUSE & MCC AT 0.0M OF THE BUILDING), GROUND FLOOR (0.0M TO 10.0M) IS OPEN.
 C) RC PUMP & OXIDATION BLOWER HOUSE (GA & RC DETAILS OF FOUNDATIONS) - OPEN BUILDING
 D) GENERAL ARRANGEMENTS OF LIMESTONE DAY SILOS & WET BALL MILL BUILDING, 2100-109-PVM-B-021, 0-62-411-0001.4, BUILDING IS OPEN.
 2. VENTILATION SYSTEM FOR THE LIMESTONE HANDLING SYSTEM, REVERSIBLE BELT FILTER SHALL BE IN BHEL ISG SCOPE.

JOB: KORBA FGD
HVAC SYSTEM FOR FGD
AXIAL FAN BILL OF QUANTITY

| Sr. No. | Type of fan | Static Pressure | | Quantity as per Fan Schedule |
|---------|-------------|-----------------|--------|------------------------------------|
| 1 | 40000 CMH | 15 | mmWCSP | 4 |
| 2 | 20000 CMH | 15 | mmWCSP | 0 |
| 3 | 10000 CMH | 30 | mmWCSP | 5 |
| 4 | 7500 CMH | 30 | mmWCSP | 0 |
| 5 | 6000 CMH | 30 | mmWCSP | 10 |
| 6 | 4000 CMH | 30 | mmWCSP | 1 |
| 7 | 10000 CMH | 20 | mmWCSP | 33 |
| 8 | 7500 CMH | 20 | mmWCSP | 0 |
| 9 | 6000 CMH | 20 | mmWCSP | 1 |
| 10 | 4000 CMH | 20 | mmWCSP | 0 |
| 11 | 15000 CMH | 15 | mmWCSP | 0 |
| 12 | 10000 CMH | 15 | mmWCSP | 0 |
| 13 | 7500 CMH | 15 | mmWCSP | 4 |
| 14 | 4000 CMH | 15 | mmWCSP | 0 |
| 15 | 2000 CMH | 15 | mmWCSP | 2 |
| 16 | 15000 CMH | 10 | mmWCSP | 1 |
| 17 | 10000 CMH | 10 | mmWCSP | 2 |
| 18 | 7500 CMH | 10 | mmWCSP | 0 |
| 19 | 6000 CMH | 10 | mmWCSP | 2 |
| 20 | 4000 CMH | 10 | mmWCSP | 1 |
| 21 | 2000 CMH | 10 | mmWCSP | 0 |
| 22 | 1000 CMH | 5 | mmWCSP | 12 |

3X200+3X500+1x500 MW NTPC KORBA TPP-FGD HVAC SYSTEM

COMPLIANCE SHEET ON TECHNICAL DATA SHEET & G.A DRAWING OF AIR-COOLED CONDENSING UNIT FOR FGD CONTROL BUILDING

DOC NO. BHEL - PE-V0-466-(571-13000-A)-A209, NTPC - 2100-109-PVM-Y-003A, R01

| SI No. | NTPC LIMITED COMMENTS ON R0 | BHEL / REPLY | NTPC LIMITED COMMENTS / REPLY ON R01 | BHEL / REPLY | NTPC LIMITED REPLY |
|--------|--|---|--|---|--------------------|
| 1 | not matching with model mentioned in GA. | Mismatch in Model No. specified in the datasheet and GA is due to Typing error. Clarification letter from OEM is enclosed in this regard. | Point Closed | - | |
| 2 | Specify the value as per capacity of the unit. | Noted and incorporated. | Point Closed | - | |
| 3 | BHEL to ensure & confirm as per specification. | Noted and confirmed. | Point Closed | - | |
| 4 | Please specify. | Noted and incorporated. | Point Closed | - | |
| 5 | Steel spring / Neoprene rubber cushy foot type with isolation efficiency not less than 85%. | Noted and incorporated. | Point Closed | - | |
| 6 | Specify the value as per capacity of the unit. | Noted and incorporated. | Point Closed | - | |
| 7 | The Compressor shall be scroll, serviceable, either hermetic type or semi-hermetic type with automatic capacity control (minimum 3 steps). | Noted and confirmed. | Point Closed | - | |
| 8 | High/Low pressure cutouts, oil pressure switches, relief valves, pressure gauges at each stage, lube oil and control oil pressure gauges, suction & discharge stop valves, Muffler, Crank case heaters, oil filters, magnetic oil separators, temperature indicators for lube oil/heaters, oil level indicators, safety thermostat for crank case heater, vibration isolators, etc. If any of accessories is/are not applicable. BHEL to clearly indicate the same in the data sheet as "Not Applicable". However, BHEL to note that non-applicability of any of the accessories shall be supported by OEM letter. | Noted and incorporated. OEM Letter is enclosed for Non-Applicable accessories. | Refer comments marked on OEM letter. Further, Applicability of following is still not clear: High/Low pressure cutouts, oil pressure switches, relief valves. | As per OEM, Condensing Unit is standard / mass manufactured items and supplied with standard accessories. Hence, many of the accessories listed in the specification is not applicable. Copy of mail received from OEM is enclosed and same is mentioned in the TDS as well. Please approve the document. | |
| 9 | Ratings of the Fuses, contactors, MCB and Relay shall be updated | Wiring Diagram provided is OEM Standard Drawing. Further Details are OEM proprietary information. | Point Closed | - | |