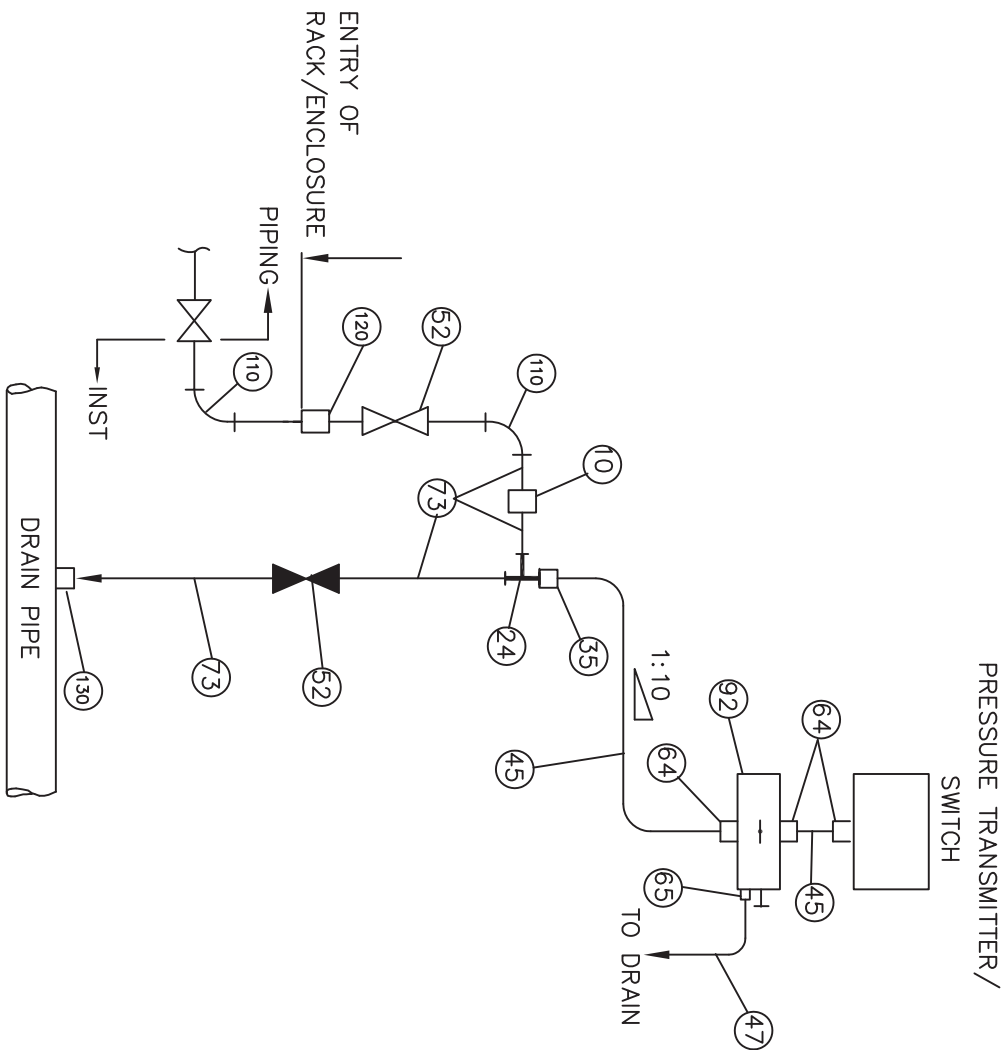


**PRESSURE TRANSMITTER/PRESSURE SWITCH  
MOUNTED ABOVE SOURCE POINT**



**BILL OF MATERIAL**

| ITEM NO. | QTY./INST | DESCRIPTION   |
|----------|-----------|---|
| 24       | 1         | EQUAL TEE (FEMALE) 1/2" SW 3000lbs                                    |
| 35       | 1         | MALE CONNECTOR 1/2" PE X 1/2" OD 3000 lbs                             |
| 52       | 2         | GLOBE VALVE 1/2" SW 600lbs  |
| 45       | 3Mtrs.    | TUBE 1/2" OD 2.1 MM THICK   |
| 64       | 3         | MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 3000 lbs                         |
| 73       | 2Mtrs     | IMPULSE PIPE 15 NB SCH 80   |
| 92       | 1         | 2 VALVES MANIFOLD 1/2" NPT(F)   |
| 10       | 1         | FULL COUPLING 1/2" SW 3000lbs   |
| 47       | 0.15Mtrs. | TUBE 8 MM OD 1.0 MM THICK   |
| 65       | 1         | MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 3000 lbs                         |
| 110      | 2         | 90° ELBOW 1/2" SW 3000lbs   |
| 120      | 1         | BULK HEAD UNION/COUPLING. CL: 3000 LBS/ 1/2" NB-SW/AS PER ANSI B16.11 |
| 130      | 1         | HALE COUPLING. CL: 3000 LBS/ 1/2" NB-SW/ AS PER ANSI B16.11           |

SERVICE : CONDENSER PRESSURE, INSTRUMENT AIR ETC.

PRELIMINARY  
TENDER PURPOSE ONLY

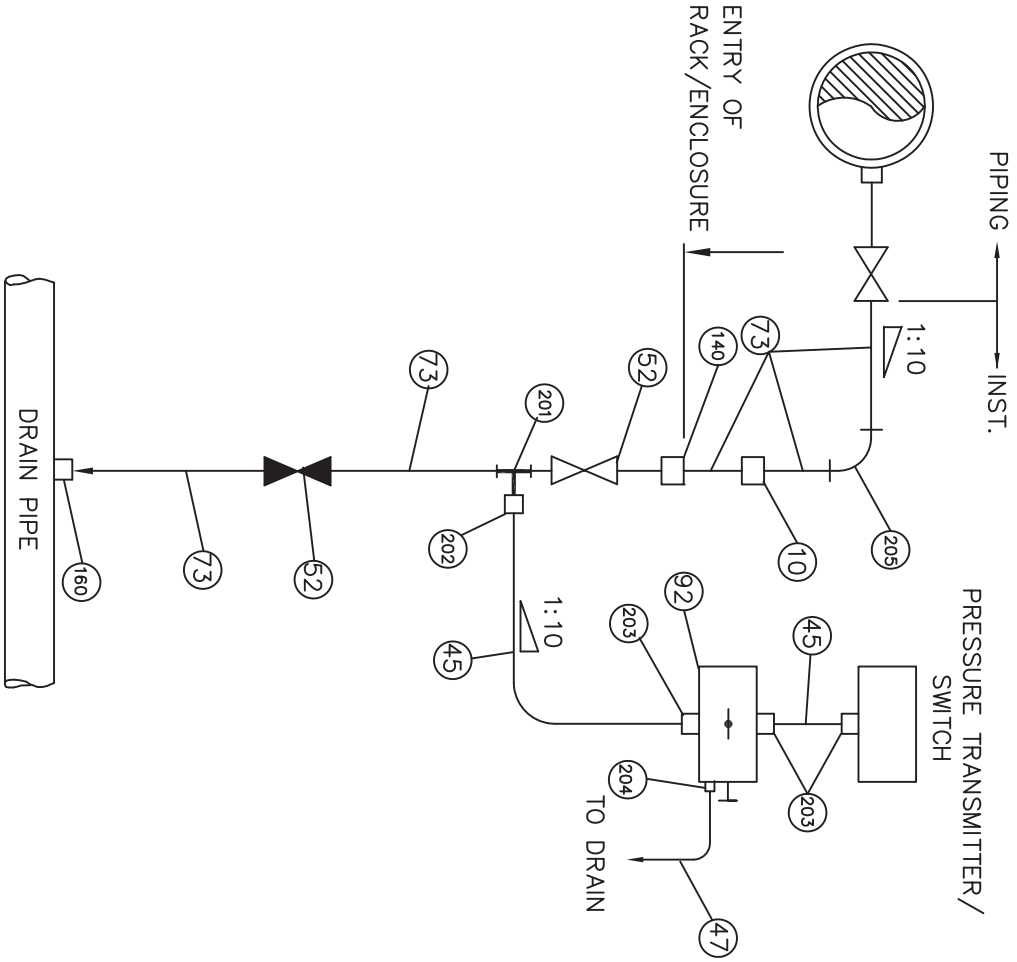
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|----------|---------|-------|-------------|------|----------|
| APPROVED | CHECKED | DRAWN | DESCRIPTION | REV. | DATE     |
|          |         |       |             | 0    | 21.04.10 |
| GP       | AT      | SD    |             |      |          |

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANKABORI THERMAL POWER STATION, GUJARAT)  
GUJARATI STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT

**DEVELOPMENT CONSULTANTS PVT. LTD.**  
CONSULTING ENGINEERS  
KOLKATA - MUMBAI - CHENNAI - NEW DELHI

JOB NO. DCP-1-K9213R SCALE NIL SH. 3 OF 20  
DWG. NO. K9213R-DWG-1-0060 REV. 0

**PRESSURE TRANSMITTER/PRESSURE SWITCH  
MOUNTED BELOW SOURCE POINT**



**BILL OF MATERIAL**

| ITEM NO. | QTY. / INST. | DESCRIPTION   |
|----------|--------------|---|
| 201      | 1            | EQUAL TEE (FEMALE) 1/2" SW 6000lbs                                  |
| 202      | 1            | MALE CONNECTOR 1/2" PE 1/2" OD 6000 lbs                             |
| 52       | 2            | GLOBE VALVES 1/2" SW 600lbs   |
| 45       | 3 Mtrs       | TUBE 1/2" OD 2.1 MM THICK   |
| 203      | 3            | MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 6000 lbs                       |
| 73       | 15Mtrs.      | IMPULSE PIPE 15 NB GRB SCH 80                                       |
| 92       | 1            | 2 VALVES MANIFOLD 1/2" NPT(F)                                       |
| 10       | 1            | FULL COUPLING 1/2" SW 6000lbs                                       |
| 47       | 1            | 0.15Mtr\$TUBE 8 MM OD 1.0 MM THICK                                  |
| 204      | 1            | MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 6000 lbs                       |
| 205      | 1            | 90° ELBOW 1/2" SW 6000lbs   |
| 140      | 1            | BULK HEAD UNION/COUPLING CL:6000 LBS/ 1/2" NB-SW AS PER ANSI B16.11 |
| 160      | 1            | HALF COUPLING CL:6000 LBS/ 1/2" NB-SW AS PER ANSI B16.11            |

SERVICE : CONDENSATE, FEED WATER ETC.

PRELIMINARY  
TENDER PURPOSE ONLY

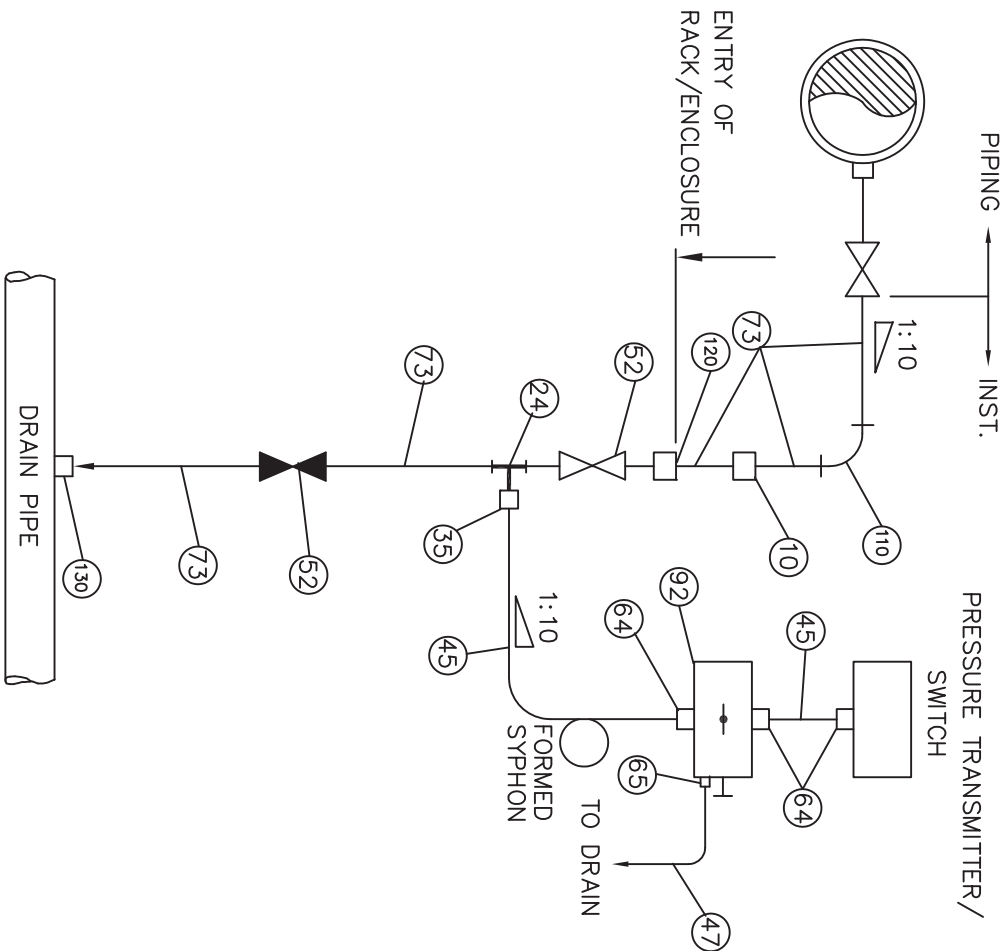
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|----------|---------|-------|------|----------|
| APPROVED | CHECKED | DRAWN | REV. | DATE     |
| GP       | AT      | SD    | 0    | 21.04.10 |

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANKBORI THERMAL POWER STATION, GUJARAT)  
GUJARATI STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT

**DEVELOPMENT CONSULTANTS PVT. LTD.**  
CONSULTING ENGINEERS  
KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DCP1-K9213R SCALE NIL SH. 4 OF 20  
DWG. NO. K9213R-DWG-I-0060 REV. 0

**PRESSURE TRANSMITTER/PRESSURE SWITCH  
MOUNTED BELOW SOURCE POINT(WITH SYPHON)**



**BILL OF MATERIAL**

| ITEM NO. | QTY./INST | DESCRIPTION  |
|----------|-----------|--|
| 24       | 1         | EQUAL TEE (FEMALE) 1/2" SW 3000lbs                                   |
| 35       | 1         | MALE CONNECTOR 1/2" PE 1/2" OD 3000 lbs                              |
| 52       | 2         | GLOBE VALVES 1/2" SW 600lbs  |
| 45       | 3 Mtrs    | TUBE 1/2" OD 2.1 MM THICK  |
| 64       | 3         | MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 3000 lbs                        |
| 73       | 15Mtrs.   | IMPULSE PIPE 15 NB SCH 80  |
| 92       | 1         | 2 VALVES MANIFOLD 1/2" NPT(F)  |
| 10       | 1         | FULL COUPLING 1/2" SW 3000lbs  |
| 47       | 0.15Mtrs. | TUBE 8 MM OD 1.0 MM THICK  |
| 65       | 1         | MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 3000 lbs                        |
| 110      | 1         | 90° ELBOW 1/2" SW 3000lbs  |
| 120      | 1         | BULK HEAD UNION/COUPLING CL: 3000 LBS/ 1/2" NB-SW AS PER ANSI B16.11 |
| 130      | 1         | HALF COUPLING CL: 3000 LBS/ 1/2" NB-SW AS PER ANSI B16.11            |

SERVICE : LOW PRESSURE STEAM

PRELIMINARY  
TENDER PURPOSE ONLY

|          |         |       |             |      |          |
|----------|---------|-------|-------------|------|----------|
| APPROVED | CHECKED | DRAWN | DESCRIPTION | REV. | DATE     |
| GP       | AT      | SD    |             | 0    | 21.04.10 |

**TYPICAL INSTRUMENT INSTALLATION DIAGRAM**

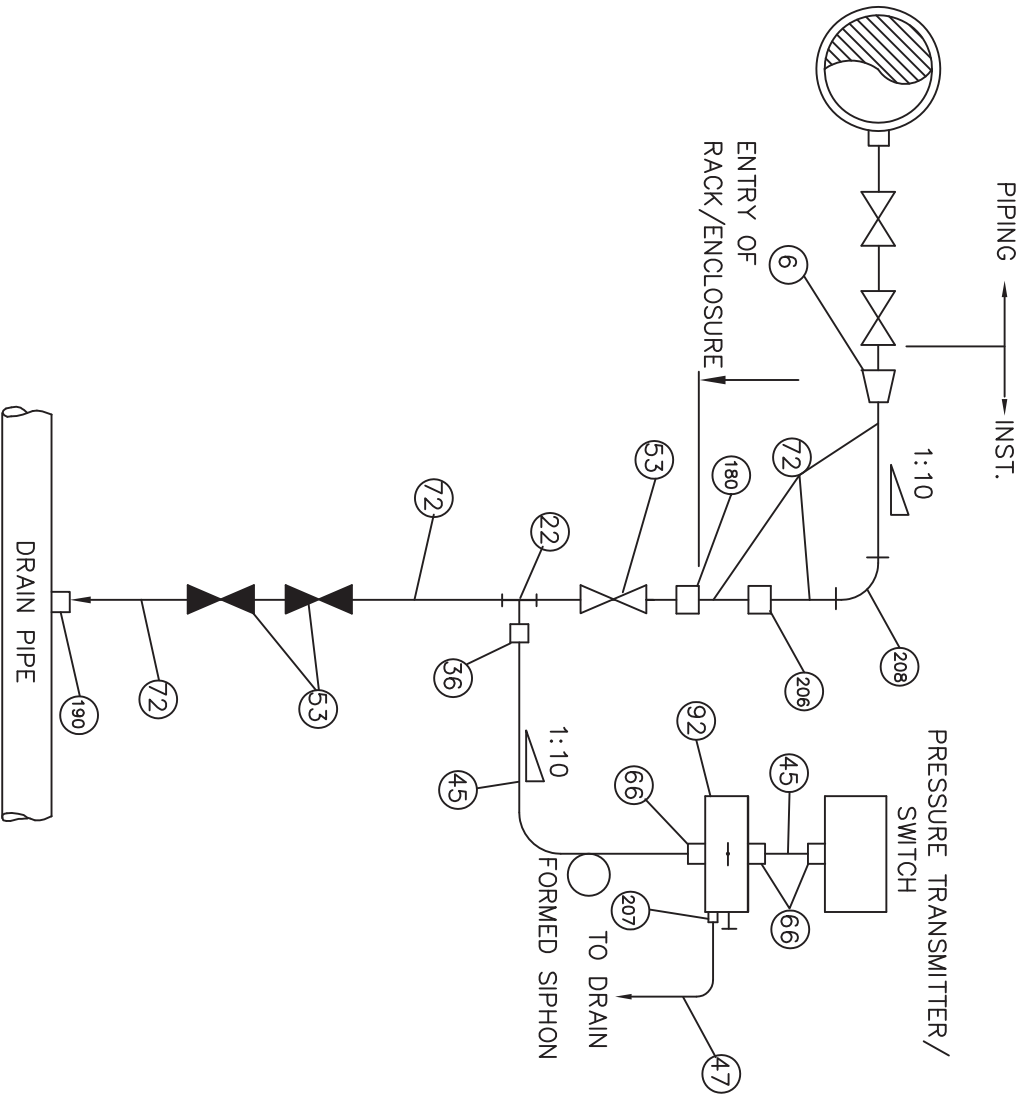
1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)  
**GUJARAT STATE ELECTRICITY CORPORATION LIMITED**  
VADODARA, GUJARAT



**DEVELOPMENT CONSULTANTS PVT. LTD.**  
CONSULTING ENGINEERS  
KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DCP-1-K9213R SCALE NIL SHEET 5 OF 20  
DWG. NO. K9213R-DWG-1-0060 REV. 0

**PRESSURE TRANSMITTER/PRESSURE SWITCH  
MOUNTED BELOW SOURCE POINT(WITH CONDENSATE POT)**



| ITEM NO. |      | QTY / INST. | DESCRIPTION  |
|----------|------|-------------|--|
| 6        | 1    | 1           | REDUCER 1" SW X 1/2" SW 9000lbs                                      |
| 22       | 1    | 1           | EQUAL TEE (FEMALE) 1/2" SW 9000lbs                                   |
| 36       | 1    | 1           | MALE CONNECTOR 1/2" PE X 1/2" OD 9000 lbs                            |
| 53       | 3    | 3           | GLOBE VALVES 1/2" SW 1500 lbs  |
| 45       | 3    | 3           | TUBE 1/2" OD 2.1 MM THICK  |
| 66       | 3    | 3           | MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 9000 lbs                        |
| 72       | 15   | 15          | IMPULSE PIPE 15 NB SCH. 80   |
| 92       | 1    | 1           | 2 VALVES MANIFOLD 1/2" NPT(F)  |
| 206      | 1    | 1           | FULL COUPLING 1/2" SW 9000lbs  |
| 47       | 0.15 | 0.15        | TUBE 8 MM OD 1.0 MM THICK  |
| 207      | 1    | 1           | MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 9000 lbs                        |
| 180      | 1    | 1           | BULK HEAD UNION/COUPLING CL: 9000 LBS-AS PER ANSI B16.11, 1/2" NB-SW |
| 190      | 1    | 1           | HALF COUPLING CL: 9000LBS/ 1/2" NB-SW AS PER ANSI B16.11             |
| 208      | 1    | 1           | 90° ELBOW 1/2" SW CL: 9000 lbs                                       |

SERVICE : MEDIUM & HIGH PRESSURE STEAM

PRELIMINARY  
TENDER PURPOSE ONLY

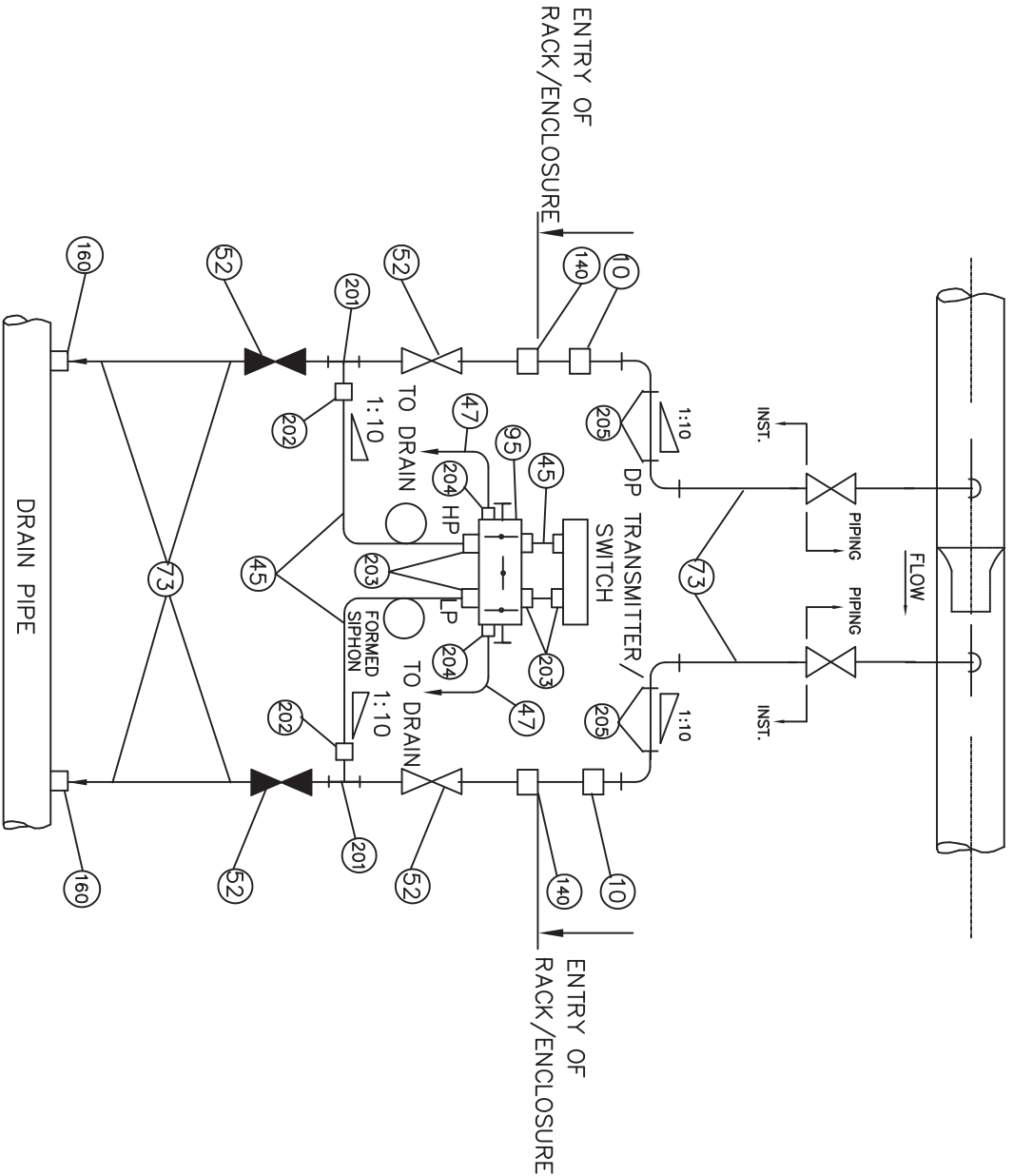
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|----------|---------|-------|-------------|------|----------|
| APPROVED | CHECKED | DRAWN | DESCRIPTION | REV. | DATE     |
| GP       | AT      | SD    |             | 0    | 21.04.10 |

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
1x800kW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WAMBORI THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT

DEVELOPMENT CONSULTANTS PVT. LTD.  
CONSULTING ENGINEERS  
KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DGPL-K9213R SCALE NIL SH. 6 OF 20  
DWG. NO. K9213R-DWG-I-0060 REV. 0

**DIFF. PRESS. TRANSMITTER/DIFF. PRESS. SWITCH  
MOUNTED BELOW SOURCE POINT**



**BILL OF MATERIAL**

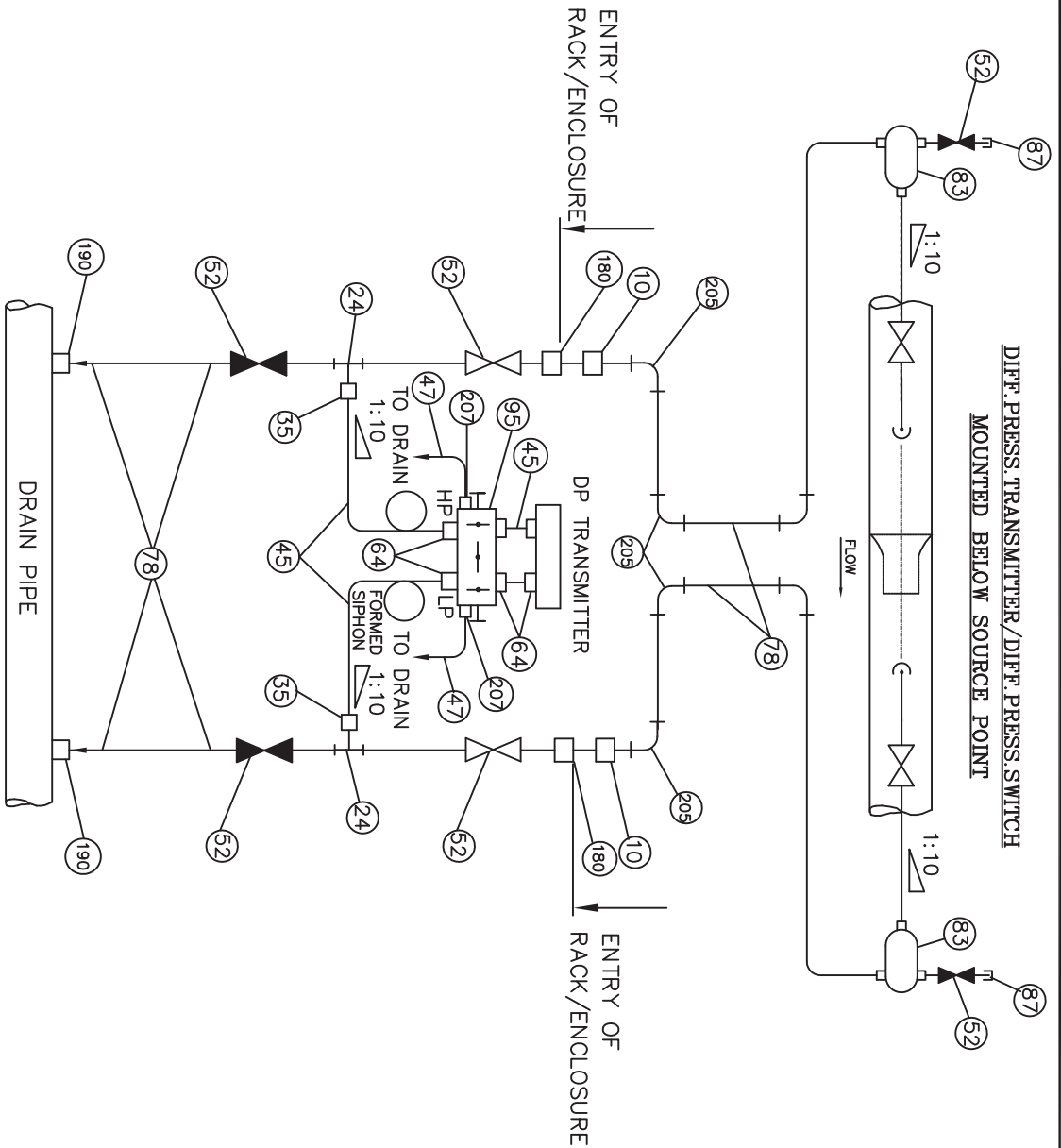
| ITEM NO. | QTY./INST. | DESCRIPTION   |
|----------|------------|---|
| 201      | 2          | EQUAL TEE (FEMALE) 1/2" SW 6000lbs                                  |
| 202      | 2          | MALE CONNECTOR 1/2" PE X 1/2" OD 6000 lbs                           |
| 52       | 4          | GLOBE VALVES 1/2" SW 600lbs   |
| 45       | 6 Mtrs     | TUBE 1/2" OD 2.1 MM THICK   |
| 203      | 6          | MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 6000 lbs                       |
| 73       | 30mtrs     | IMPULSE PIPE 15 NB GR.B SCH 80                                      |
| 95       | 1          | 5 VALVE MANIFOLD 1/2" NPT(F)  |
| 10       | 2          | FULL COUPLING 1/2" SW 6000lbs                                       |
| 47       | 0.3mtrs    | TUBE 8 MM OD 1.0 MM THICK   |
| 204      | 2          | MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 6000 lbs                       |
| 205      | 4          | 90° ELBOW 1/2" SW 6000lbs   |
| 140      | 2          | BULK HEAD UNION/COUPLING CL:6000 LBS/ 1/2" NB-SW AS PER ANSI B16.11 |
| 160      | 2          | HALF COUPLING CL:6000 LBS/ 1/2" NB-SW AS PER ANSI B16.11            |

SERVICE : CONDENSATE, FEED WATER ETC.

PRIMARY ELEMENT : FLOW NOZZLE/ORIFICE

PRELIMINARY  
TENDER PURPOSE ONLY

|   |  |         |           |       |  |  |  |      |        |          |  |
|---|--|---------|-----------|-------|--|--|--|------|--------|----------|--|
| APPROVED  |  | CHECKED |           | DRAWN |  | DESCRIPTION  |  | REV. |        | DATE     |  |
| gp  |  | AT      |           | SD    |  |  |  | 0    |        | 21.04.10 |  |
| <p>1:8000W SUPER CRITICAL THERMAL POWER PROJECT<br/>(UNIT #8 AT WANABORI THERMAL POWER STATION, GUJARAT)</p> <p>GUJARAT STATE ELECTRICITY CORPORATION LIMITED<br/>VADODARA, GUJARAT</p> |  |         |           |       |  |  |  |      |        |          |  |
| TYPICAL INSTRUMENT INSTALLATION DIAGRAM   |  |         |           |       |  | <p>DEVELOPMENT CONSULTANTS PVT. LTD.<br/>CONSULTING ENGINEERS<br/>KOLKATA · MUMBAI · CHENNAI · NEW DELHI</p> |  |      |        |          |  |
| JOB NO. DCP L-K9213R  |  |         | SCALE NIL |       |  | SHT. 7 OF 20   |  |      | REV. 0 |          |  |
| DWG. NO. K9213R-DWG-1-0060  |  |         |           |       |  |  |  |      |        |          |  |



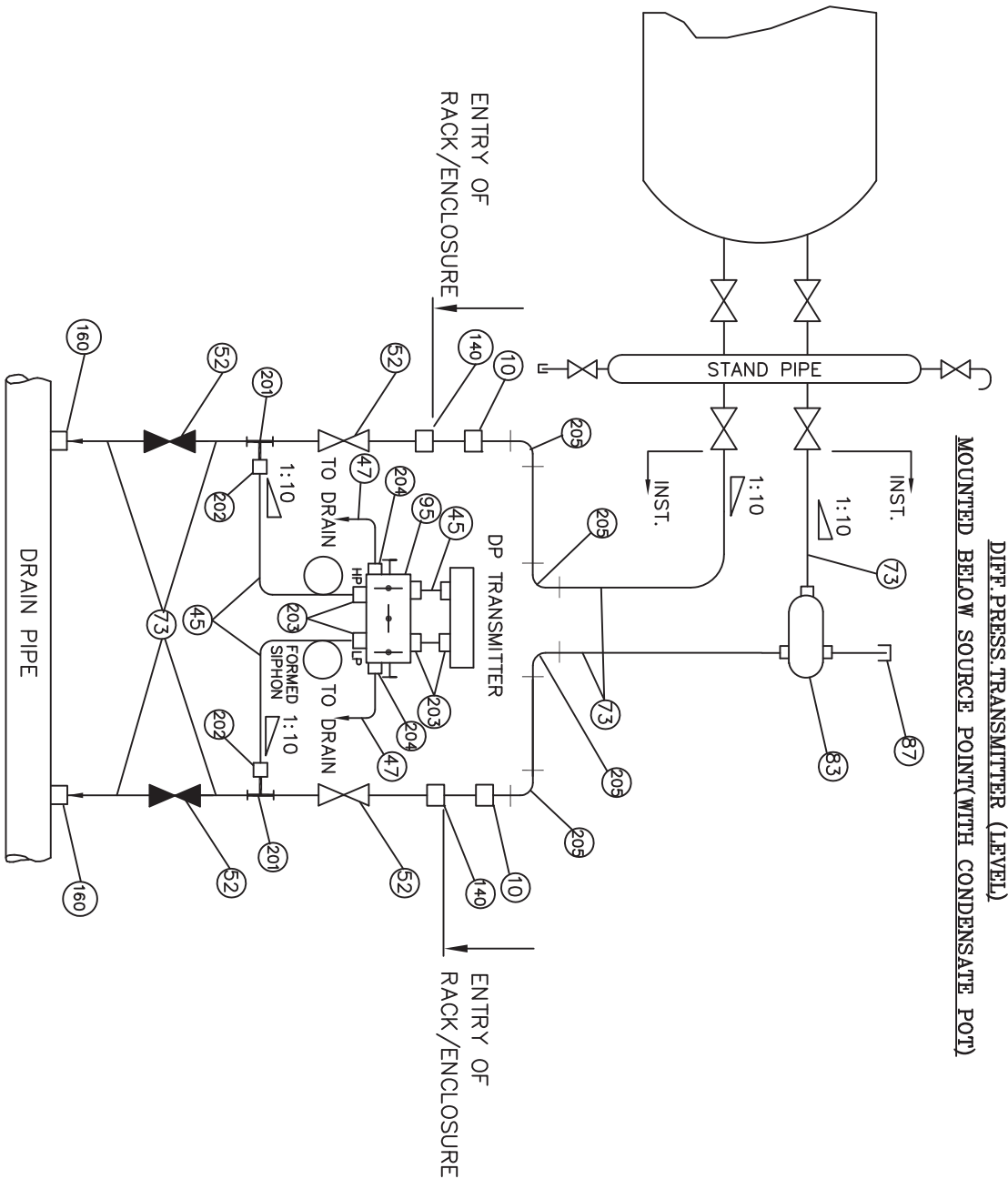
| BILL OF MATERIAL |   |
|------------------|---|
| ITEM NO.         | DESCRIPTION   |
| 24               | EQUAL TEE (FEMALE) 1/2" SW 9000lbs                                    |
| 35               | MALE CONNECTOR 1/2" PE X 1/2" OD 9000 lbs                             |
| 52               | GLOBE VALVES 1/2" SW 600lbs   |
| 45               | TUBE 1/2" OD 2.1 MM THICK   |
| 64               | MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 9000 lbs                         |
| 78               | IMPULSE PIPE 15 NB SCH 80   |
| 95               | 5 VALVES MANIFOLD 1/2" NPT(F)   |
| 10               | FULL COUPLING 1/2" SW 9000lbs   |
| 83               | CONDENSATION POT 1/2" SW NPT(F) 9000 lbs                              |
| 87               | PLUG 1/2" NPT(F) 9000lbs  |
| 47               | 0.3mtrs TUBE 8 MM OD 1.0 MM THICK                                     |
| 207              | MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 9000 lbs                         |
| 205              | 90° ELBOW 1/2" SW 9000lbs   |
| 180              | BULK HEAD UNION/COUPLING CL: 9000 LBS--AS PER ANSI B16.11, 1/2" NB-SW |
| 190              | HALF COUPLING CL: 9000 LBS/ 1/2" NB-SW AS PER ANSI B16.11             |

SERVICE : STEAM

PRIMARY ELEMENT : FLOW NOZZLE/ORIFICE

PRELIMINARY  
TENDER PURPOSE ONLY

|  |  |         |  |                                       |  |             |  |                                   |  |          |  |
|--|--|---------|--|---------------------------------------|--|-------------|--|-----------------------------------|--|----------|--|
| APPROVED   |  | CHECKED |  | DRAWN                                 |  | DESCRIPTION |  | REV.                              |  | DATE     |  |
| GP   |  | AT      |  | SD                                    |  |             |  | 0                                 |  | 21.04.10 |  |
| <p>TYPICAL INSTRUMENT INSTALLATION DIAGRAM</p> <p>1x800MW SUPER CRITICAL THERMAL POWER PROJECT<br/>(UNIT #8 AT WANKABORI THERMAL POWER STATION, GUJARAT)</p> <p>GUJARATI STATE ELECTRICITY CORPORATION LIMITED<br/>VADODARA, GUJARAT</p> |  |         |  |                                       |  |             |  |                                   |  |          |  |
| <p>DEVELOPMENT CONSULTANTS PVT. LTD.<br/>KOLKATA - MUMBAI - CHENNAI - NEW DELHI</p>  |  |         |  | <p>JOB NO. DCP-1-K9213R SCALE NIL</p> |  |             |  | <p>DWG. NO. K9213R-DWG-1-0060</p> |  |          |  |
|  |  |         |  | SHT. 8 OF 20                          |  |             |  | REV. 0                            |  |          |  |



DIFF. PRESS. TRANSMITTER (LEVEL) MOUNTED BELOW SOURCE POINT (WITH CONDENSATE POT)

| BILL OF MATERIAL |  |
|------------------|--|
| ITEM NO.         | DESCRIPTION  |
| 201              | EQUAL TEE (FEMALE) 1/2" SW 6000lbs                                   |
| 202              | MALE CONNECTOR 1/2" PE X 1/2" OD 6000 lbs                            |
| 52               | GLOBE VALVES 1/2" SW 6000lbs   |
| 45               | TUBE 1/2" OD 2.1 MM THICK  |
| 203              | MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 6000 lbs                        |
| 73               | 30Mtrs IMPULSE PIPE 15 NB SCH 80                                     |
| 95               | 5 VALVES MANIFOLD 1/2" NPT(F)  |
| 10               | FULL COUPLING 1/2" SW 6000lbs  |
| 83               | CONDENSATE POT 1/2" SW 6000lbs                                       |
| 87               | PLUG 1/2" NPT(M) 6000lbs   |
| 205              | 90° ELBOW 1/2" SW 6000lbs  |
| 47               | 0.3Mtrs TUBE 8 MM OD 1.0 MM THICK                                    |
| 204              | MALE CONNECTOR 1/4" NPT(M) X 8 MM OD 6000 lbs                        |
| 140              | BULK HEAD UNION/COUPLING CL: 6000 LBS-AS PER ANSI B16.11, 1/2" NB-SW |
| 160              | HALF COUPLING CL: 6000 LBS/ 1/2" NB-SW AS PER ANSI B16.11            |

SERVICE : BOILER DRUM, DEAERATOR, HEATERS

PRELIMINARY  
TENDER PURPOSE ONLY

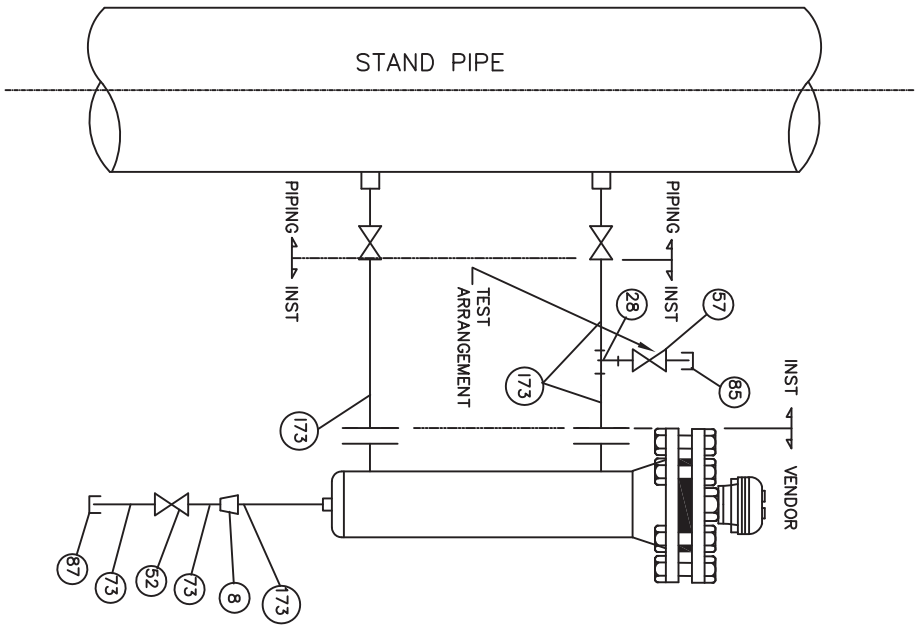
|          |         |       |             |      |          |
|----------|---------|-------|-------------|------|----------|
| APPROVED | CHECKED | DRAWN | DESCRIPTION | REV. | DATE     |
| GP       | AT      | SD    |             | 0    | 21.04.10 |

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANKBORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

DEVELOPMENT CONSULTANTS PVT. LTD.  
 CONSULTING ENGINEERS  
 KOLKATA, MUMBAI, CHENNAI, NEW DELHI

JOB NO. DCP1-K9213R SCALE NIL SHF. 9 OF 20  
 DWG. NO. K9213R-DWG-1-0060 REV. 0

**FLOAT OPERATED LEVEL SWITCH**



| BILL OF MATERIALS |                                    |
|-------------------|------------------------------------|
| ITEM NO           | QTY/ INST / DESCRIPTION            |
| 52                | 1 GLOBE VALVE 1/2" SW 600lbs       |
| 73                | 0.5Mtrs IMPULSE PIPE 15 NB SCH.80  |
| 87                | 1 PULG 1/2" NPT(M) 3000lbs         |
| 28                | 2 EQUAL TEE (FEMALE) 1" SW 3000lbs |
| 173               | 1 Mtrs IMPULSE PIPE 25 NB SCH.80   |
| 8                 | 1 REDUCER 1" SW X 1/2" SW 3000lbs  |
| 57                | 1 GLOBE VALVE 1" SW 600 lbs        |
| 85                | 1 PLUG 1" NPT(F) 3000 lbs          |

SERVICE : CONDENSATE

PRELIMINARY  
TENDER PURPOSE ONLY

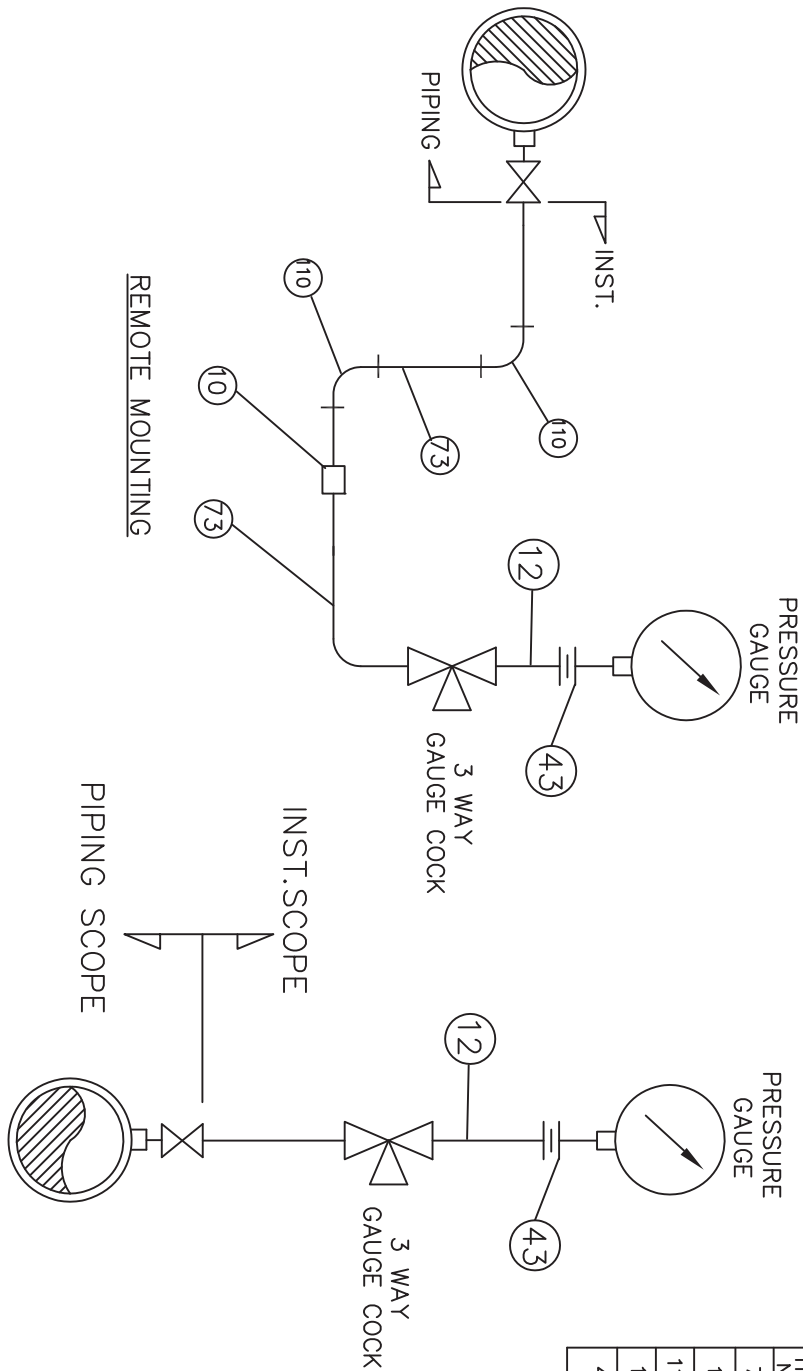
|          |         |       |             |      |          |
|----------|---------|-------|-------------|------|----------|
| APPROVED | CHECKED | DRAWN | DESCRIPTION | REV. | DATE     |
| GP       | AT      | SD    |             | 0    | 21.04.10 |

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1.8000MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT



**DEVELOPMENT CONSULTANTS PVT. LTD.**  
 CONSULTING ENGINEERS  
 KOKKATA, MUMBAI, CHENNAI, NEW DELHI

JOB NO. DGPL-K9213R SCALE NIL SH. 10 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0



SERVICE : WATER, CONDENSATE ETC.

| BILL OF MATERIAL |            |   |
|------------------|------------|---|
| ITEM NO.         | QTY./INST. | DESCRIPTION   |
| 73               | 15Mtrs     | IMPULSE PIPE 15 NB SCH.80                               |
| 10               | 1          | FULL COUPLING 1/2" SW 3000lbs                           |
| 110              | 2          | 90° ELBOW 1/2" SW 3000lbs                               |
| 12               | 1          | 1/2" NPT(M) X 1/2" PE 4" LONG NIPPLE                    |
| 43               | 1          | NUT & TAIL FITTING WITH CU WASHER 1/2" NPT(F) X 1/2" PE |

PRELIMINARY  
TENDER PURPOSE ONLY

TYPICAL INSTRUMENT INSTALLATION DIAGRAM

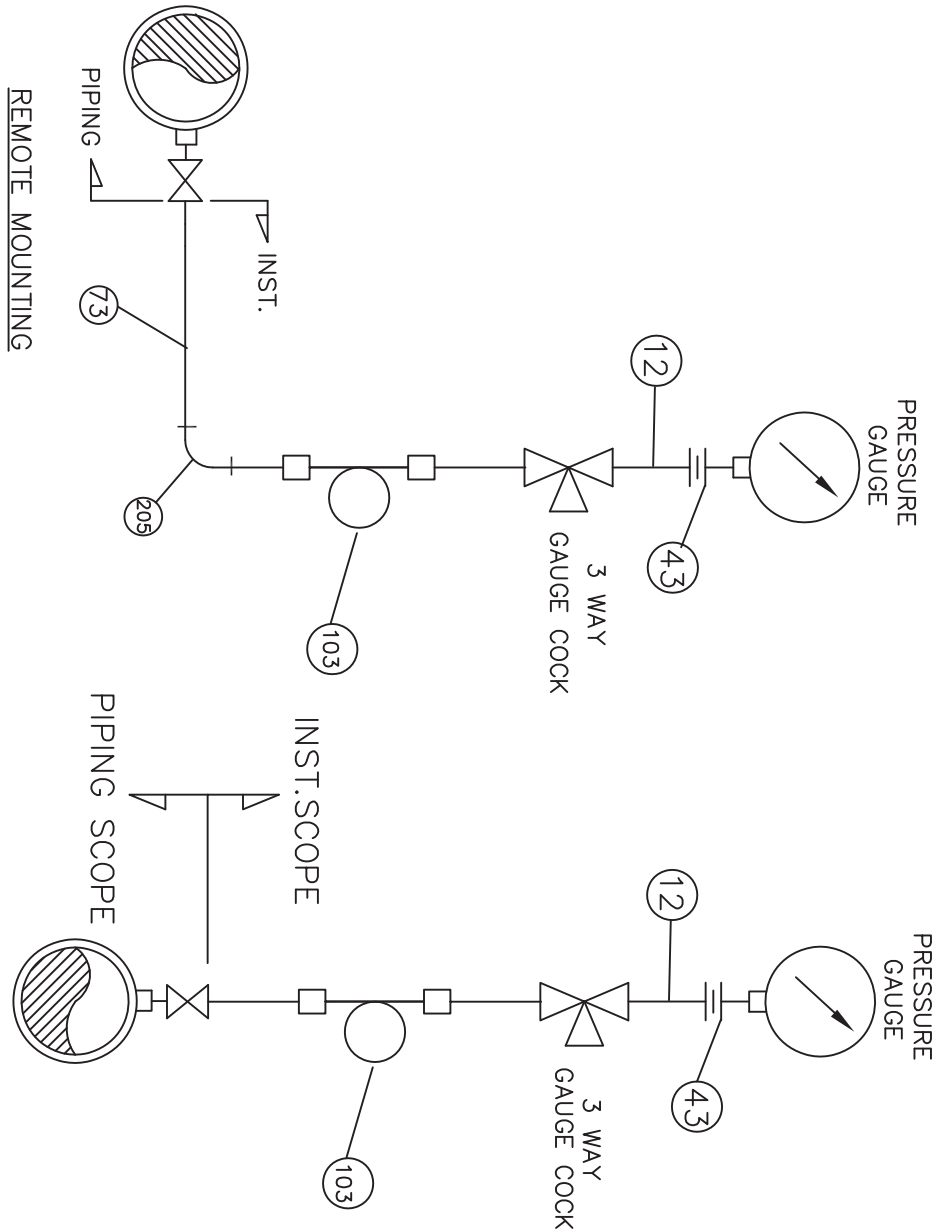
1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
(UNIT #8 AT WANKAREBARI THERMAL POWER STATION, GUJARAT)  
GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VADODARA, GUJARAT



DEVELOPMENT CONSULTANTS PVT. LTD.  
CONSULTING ENGINEERS  
KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DCPL-K9213R SCALE NIL SHT. 11 OF 20  
DWG. NO. K9213R-DWG-I-0060 REV. 0

|          |         |       |             |      |          |
|----------|---------|-------|-------------|------|----------|
| APPROVED | CHECKED | DRAWN | DESCRIPTION | REV. | DATE     |
| GP       | AT      | SD    |             | 0    | 21.04.10 |



| BILL OF MATERIAL |  |
|------------------|--|
| ITEM NO.         | QTY./INST./DESCRIPTION                                   |
| 73               | 15Mtrs IMPULSE PIPE 15 NB SCH.80                         |
| 205              | 2 90° ELBOW 1/2" SW 6000lbs                              |
| 12               | 1 1/2" NPT(M) X 1/2" PE 4" LONG NIPPLE                   |
| 43               | 1 NUT & TAIL FITTING WITH SS WASHER 1/2"NPT(F) X 1/2" PE |
| 103              | 1 SYPHON 1/2" OD SCH.80                                  |

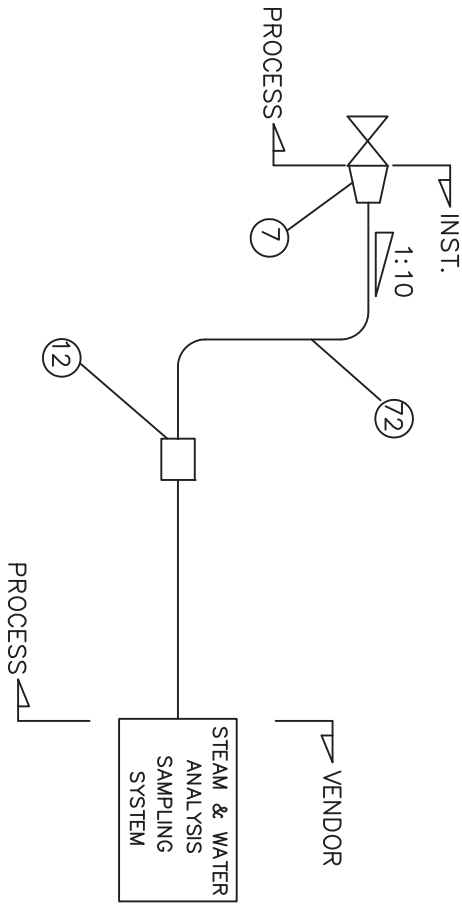
SERVICE : STEAM, FEED WATER

PRELIMINARY  
TENDER PURPOSE ONLY

|  |         |       |               |
|--|---------|-------|---------------|
| TYPICAL INSTRUMENT INSTALLATION DIAGRAM  |         |       |               |
| 1x800MW SUPER CRITICAL THERMAL POWER PROJECT<br>(UNIT #8 AT WANABRON THERMAL POWER STATION, GUJARAT) |         |       |               |
| GUJARAT STATE ELECTRICITY CORPORATION LIMITED<br>VADODARA, GUJARAT                                   |         |       |               |
| APPROVED   | CHECKED | DRAWN | DESCRIPTION   |
| GP   | AT      | SD    |               |
|  |         |       | REV. 0        |
|  |         |       | DATE 21.04.10 |

DEVELOPMENT CONSULTANTS PVT. LTD.  
CONSULTING ENGINEERS  
KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DCP-L-K9213R SCALE NIL SH. 12 OF 20  
DWG. NO. K9213R-DWG-I-0060 REV. 0



| BILL OF MATERIAL |                                  |
|------------------|----------------------------------|
| ITEM NO. / INST  | DESCRIPTION                      |
| 12               | FULL COUPLING 1/2" SW 6000 lbs   |
| 7                | REDUCER 1" SW X 1/2" SW 6000 lbs |
| 72               | A/R IMPULSE PIPE 15 NB SCH 80    |

|          |         |       |             |      |          |
|----------|---------|-------|-------------|------|----------|
| APPROVED | CHECKED | DRAWN | DESCRIPTION | REV. | DATE     |
| GP       | AT      | SD    |             | 0    | 21.04.10 |

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANABORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

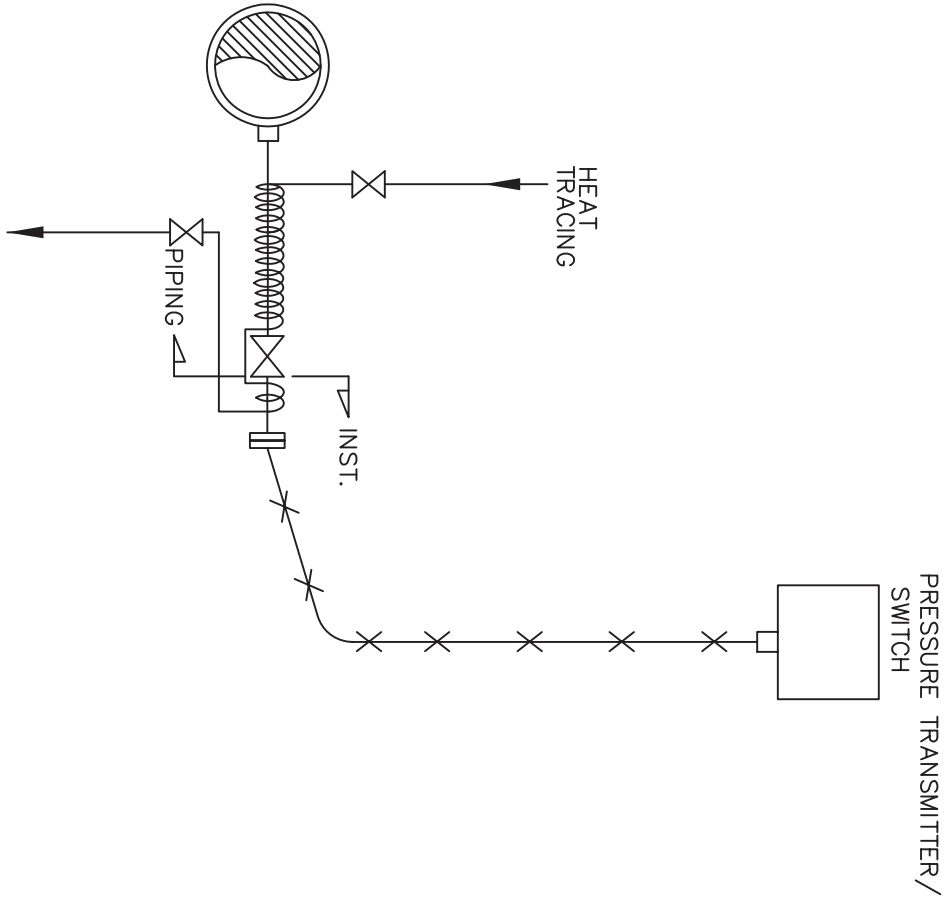


**DEVELOPMENT CONSULTANTS PVT. LTD.**  
 CONSULTING ENGINEERS  
 KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DCP-1-K9213R SCALE NIL SH. 13 OF 20  
 DWG. NO. K9213R-DWG-1-0060 REV. 0

PRELIMINARY  
 TENDER PURPOSE ONLY


**PRESSURE TRANSMITTER/PRESSURE SWITCH  
IN HFO SERVICE**



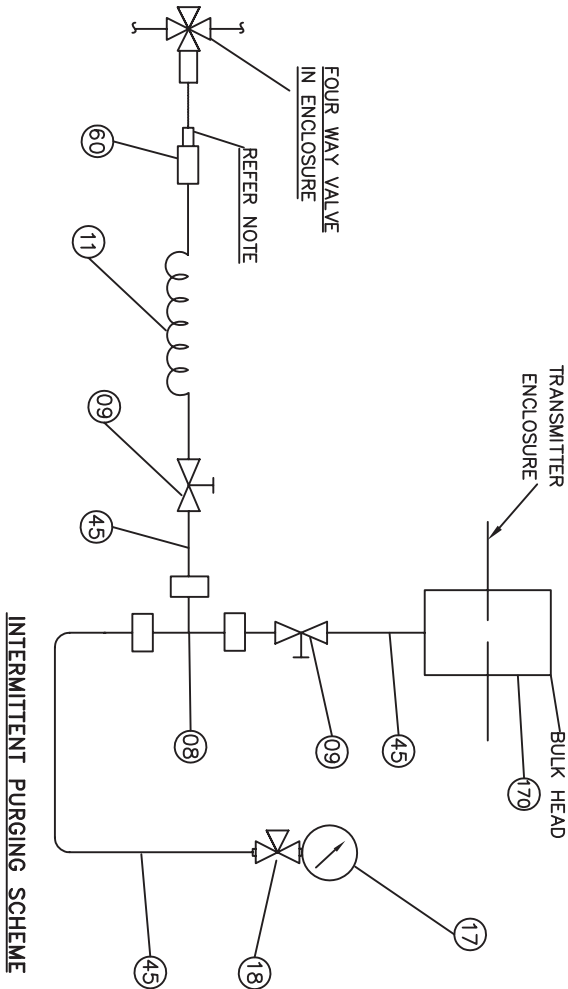
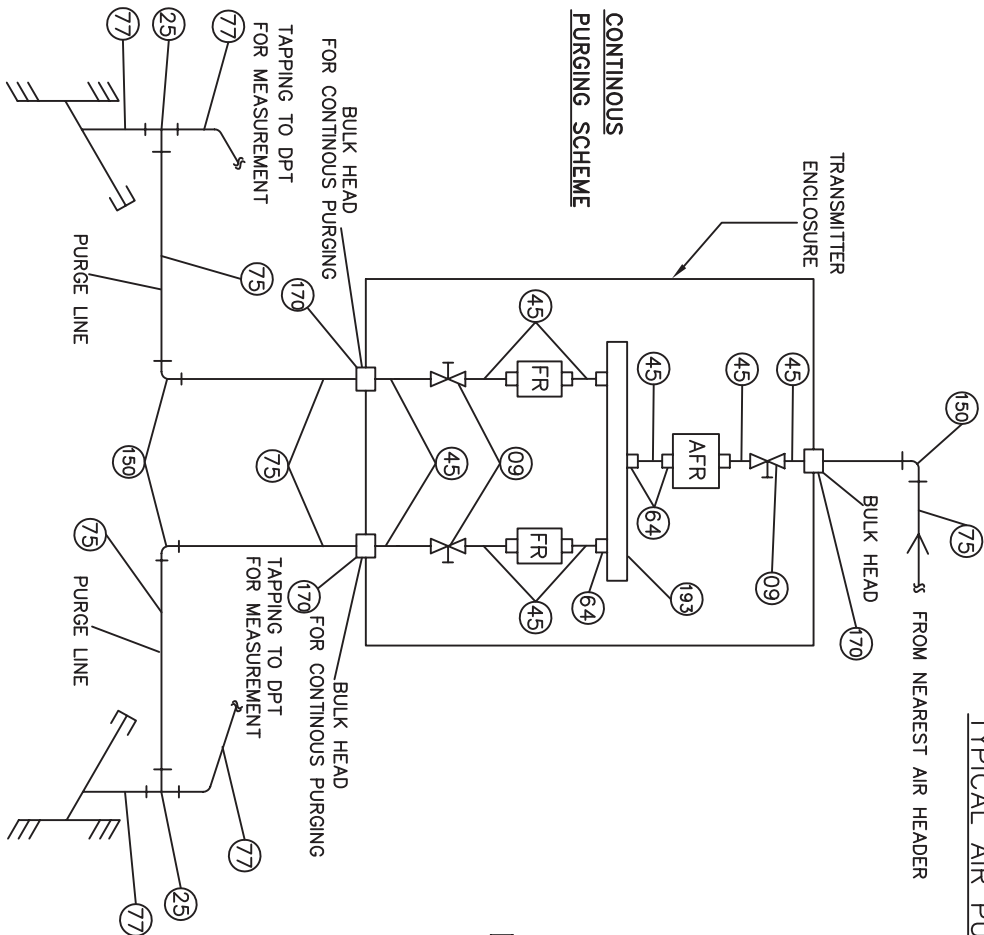
PRELIMINARY  
TENDER PURPOSE ONLY

|          |         |       |      |          |
|----------|---------|-------|------|----------|
| APPROVED | CHECKED | DRAWN | REV. | DATE     |
| GP       | AT      | SD    | 0    | 21.04.10 |

|   |
|---|
| TYPICAL INSTRUMENT INSTALLATION DIAGRAM   |
| 1x800MW SUPER CRITICAL THERMAL POWER PROJECT<br>(UNIT #8 AT WANAKBORI THERMAL POWER STATION, GUJARAT) |
| GUJARAT STATE ELECTRICITY CORPORATION LIMITED<br>VADODARA, GUJARAT                                    |

|   |                            |           |               |
|---|----------------------------|-----------|---------------|
|  <p><b>DEVELOPMENT CONSULTANTS PVT. LTD.</b><br/>CONSULTING ENGINEERS<br/>KOLKATA · MUMBAI · CHENNAI · NEW DELHI</p> | JOB NO. DCP L-K9213R       | SCALE NIL | SHT. 14 OF 20 |
|   | DWG. NO. K9213R-DWG-I-0060 |           | REV. 0        |

TYPICAL AIR PURGING SCHEMES



**NOTE:**  
 QUICK DISCONNECTING FITTING IS CONNECTED TO  
 FOUR WAY VALVE WHERE INTERMITTENT PURGING  
 IS CALLED IN SCHEME.  
 FR-FLOW REGULATOR

CONTINUE TO SH. NO. 16/20

PRELIMINARY  
 TENDER PURPOSE ONLY


|          |         |       |             |      |          |
|----------|---------|-------|-------------|------|----------|
| APPROVED | CHECKED | DRAWN | DESCRIPTION | REV. | DATE     |
| GP       | AT      | SD    |             | 0    | 21.04.10 |

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #9 AT WANAKBORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

DEVELOPMENT CONSULTANTS PVT. LTD.  
 CONSULTING ENGINEERS  
 KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DCPL-K9213R SCALE NIL SH. 15 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0

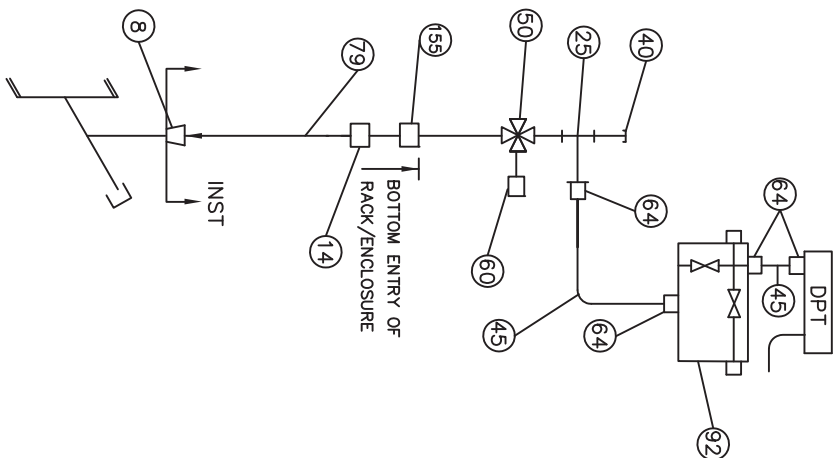
| BILL OF MATERIAL |  |
|------------------|--|
| ITEM NO.         | DESCRIPTION  |
| 77               | IMPULSE PIPE 3/4" NB   |
| 75               | GI PIPE/1/2" NB  |
| 25               | FORGED UNEQUAL TEE/AS PER ANSI B16.11<br>SIZE: 2 X 3/4" NB SW X 1/2"NPTF/CL 3000                               |
| 150              | GALVANISED ELBOW CL 3000<br>SIZE: 1/2" NPTF  |
| 60               | QUICK DISCONNECTING FITTING  |
| 11               | MALE/END CONN. TO SUIT 1/2" OD CONN.<br>NYLON NOSE TO SUIT 1/2" END<br>CONN./Pr. TESTING 10 Kg/cm <sup>2</sup> |
| 45               | SEAMLESS TUBE 1/2" OD TUBE X 2.1 MM THK.   |
| 170              | BULK HEAD COUPLING TO SUIT 1/2" OD TUBE<br>& 1/2" NB PIPE  |
| 09               | BALL VALVETO SUIT 1/2" OD TUBE   |
| 64               | MALE CONNECTOR 1/2" NPT(M) X 1/2" OD 3000lbs   |
| 193              | INSTRUMENT AIR HEADER 1" NB PIPE   |
| 08               | EQUAL TEE/SS 316/TO SUIT 1/2" OD TUBE.   |
| 17               | Pr. GAUGE/4" DIAL SIZE/RANGE 0-10 Kg/cm <sup>2</sup><br>CONNECTION 1/2" NPTM                                   |
| 18               | 3 WAY GAUGE 1/2"NPTF X TO SUIT 1/2" TUBE.  |

|          |         |       |             |      |          |  |   |               |                   |       |          |      |
|----------|---------|-------|-------------|------|----------|--|---|---------------|-------------------|-------|----------|------|
| APPROVED | CHECKED | DRAWN | DESCRIPTION | REV. | DATE     | TYPICAL INSTRUMENT INSTALLATION DIAGRAM<br>1x800MW SUPER CRITICAL THERMAL POWER PROJECT<br>(UNIT #9 AT WANKABORI THERMAL POWER STATION, GUJARAT)<br>GUJARAT STATE ELECTRICITY CORPORATION LIMITED<br>VADODARA, GUJARAT |  DEVELOPMENT CONSULTANTS PVT. LTD.<br>CONSULTING ENGINEERS<br>KOLKATA · MUMBAI · CHENNAI · NEW DELHI | JOB NO.       | DWG. NO.          | SCALE | SHT.     | REV. |
| GP       | AT      | SD    |             | 0    | 21.04.10 |  |   | K9213R-K9213R | K9213R-DWG-I-0060 | NIL   | 16 OF 20 | 0    |

PRELIMINARY  
TENDER PURPOSE ONLY



**DIFF. PRESSURE TRANSMITTER  
MOUNTED ABOVE SOURCE POINT**



| BILL OF MATERIAL |   |
|------------------|---|
| ITEM NO.         | DESCRIPTION   |
| 8                | REDUCER 1" BSPF X 3/4" NB-SW CL 3000  |
| 14               | FORGED COUPLING 3/4" SW CL 3000/AS PER ANSI B16.11                                |
| 25               | FORGED UNEQUAL TEE AS PER ANSI B16.11<br>SIZE : 2 X 3/4" NB-SW X 1/2" NPTF/CL3000 |
| 40               | NIPPLE & CAP<br>3/4" NB-SCH 80/CAP-3/4" NPTF                                      |
| 45               | SEAMLESS TUBE<br>1/2" OD X 2.1 MM THK.  |
| 50               | FOUR WAY VALVE<br>SIZE : (2 X 3/4" NB-SW) X (2 X 1/2" NPTF) CL: 800               |
| 60               | QUICK DISCONNECTING FITTING<br>SIZE: 1/2" NPTM                                    |
| 64               | MALE CONNECTOR /SS 316<br>1/2" NPT(M) X TO SUIT 1/2" OD TUBE                      |
| 79               | 30Mtrs SEAMLESS PIPE/3/4" NB SCH 80   |
| 92               | 2 VALVE MANIFOLD 1/2" NPT(F)  |
| 155              | BULK HEAD COUPLING CL 3000<br>SIZE : 3/4" SW /CL 3000/AS PER ANSI B16.11          |

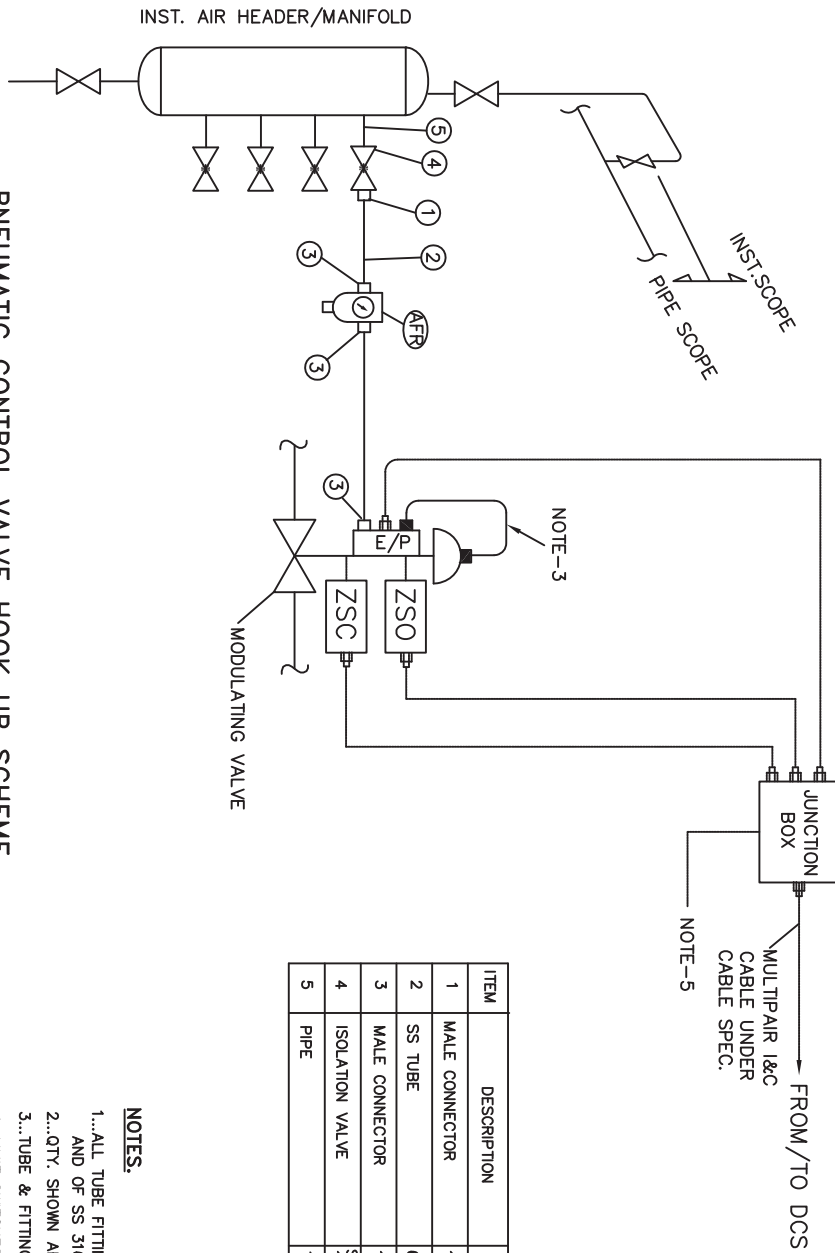
SERVICE : FLUE GAS, PRIMARY AIR, SECONDARY AIR ETC.  
NOTE : AIR PURGING ARRANGEMENT SHALL BE INCLUDED.

PRELIMINARY  
TENDER PURPOSE ONLY

|          |         |       |      |          |
|----------|---------|-------|------|----------|
| APPROVED | CHECKED | DRAWN | REV. | DATE     |
| GP       | AT      | SD    | 0    | 21.04.10 |

|   |                   |   |     |      |          |
|---|-------------------|---|-----|------|----------|
| TYPICAL INSTRUMENT INSTALLATION DIAGRAM   |                   | <p><b>DEVELOPMENT CONSULTANTS PVT. LTD.</b><br/>CONSULTING ENGINEERS<br/>KOLKATA · MUMBAI · CHENNAI · NEW DELHI</p> |     |      |          |
| 1x800MW SUPER CRITICAL THERMAL POWER PROJECT<br>(UNIT #8 AT WANAABORI THERMAL POWER STATION, GUJARAT)<br>GUJARAT STATE ELECTRICITY CORPORATION LIMITED<br>VADODARA, GUJARAT |                   |   |     |      |          |
| JOB NO.   | DCPL-K9213R       | SCALE   | NIL | SHT. | 18 OF 20 |
| DWG. NO.  | K9213R-DWG-I-0060 |   |     | REV. | 0        |

A4\_H (08-'06) [297 x 210]



**PNEUMATIC CONTROL VALVE HOOK UP SCHEME**

| ITEM | DESCRIPTION     | SPECIFICATION                             | QTY.     | REMARKS |
|------|-----------------|---|----------|---------|
| 1    | MALE CONNECTOR  | 1/2" NPT(M) X 6 mm OD COMPRN.             | 1        |         |
| 2    | SS TUBE         | 6 mm OD X 1 mm THK.                       | 10 MTRS. |         |
| 3    | MALE CONNECTOR  | 1/4" NPT(M) X 6 mm OD COMPRN.             | 3        |         |
| 4    | ISOLATION VALVE | SS BALL TYPE 600LBS 1/2" SW X 1/2" NPT(F) |          |         |
| 5    | PIPE            | 1/2" NB SCH 40S                           | A/R      |         |

**NOTES.**

- 1...ALL TUBE FITTINGS ARE OF DOUBLE COMPRESSION TYPE AND OF SS 316 MATERIAL.
- 2...QTY. SHOWN ARE TYPICAL FOR ONE INSTALLATION ONLY.
- 3...TUBE & FITTINGS MARKED ■ ARE INTEGRAL TO THE VALVE.
- 4...LIMIT SWITCHES WILL BE CONNECTED WHEREVER APPLICABLE.
- 5...JUNCTION BOX WILL BE INTEGRAL TO ACTUATOR.
- 6...ISOLATION VALVE SHALL BE INSTALLED CLOSE TO THE VALVE ASSEMBLY.

PRELIMINARY  
TENDER PURPOSE ONLY

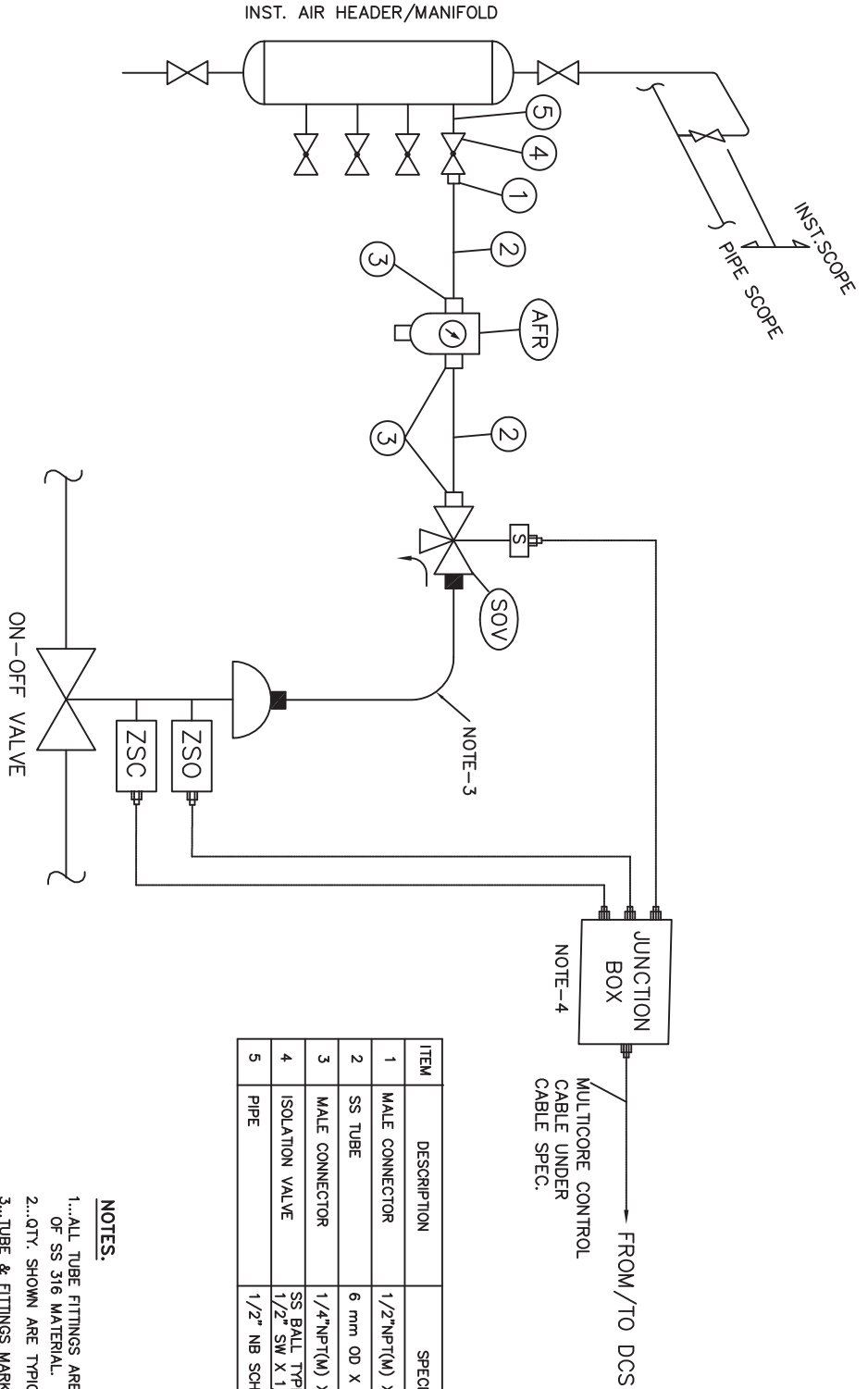
|          |         |       |      |          |
|----------|---------|-------|------|----------|
| APPROVED | CHECKED | DRAWN | REV. | DATE     |
| GP       | AT      | SD    | 0    | 21/04/10 |

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WANAJORI THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADDARA, GUJARAT



DEVELOPMENT CONSULTANTS PVT. LTD.  
 CONSULTING ENGINEERS  
 KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DCPL-K9213R SCALE NIL SH. 19 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0



| ITEM | DESCRIPTION     | SPECIFICATION                                | QTY.     | REMARKS |
|------|-----------------|--|----------|---------|
| 1    | MALE CONNECTOR  | 1/2" NPT(M) X 6 mm OD COMPR.                 | 1        |         |
| 2    | SS TUBE         | 6 mm OD X 1.0 mm THK.                        | 10 MTRS. |         |
| 3    | MALE CONNECTOR  | 1/4" NPT(M) X 6 mm OD COMPR.                 | 3        |         |
| 4    | ISOLATION VALVE | SS BALL TYPE 600LBS<br>1/2" SW X 1/2" NPT(F) |          |         |
| 5    | PIPE            | 1/2" NB SCH 40S                              | A/R      |         |

**NOTES.**

- 1...ALL TUBE FITTINGS ARE OF DOUBLE COMPRESSION TYPE AND OF SS 316 MATERIAL.
- 2...QTY. SHOWN ARE TYPICAL FOR ONE INSTALLATION ONLY.
- 3...TUBE & FITTINGS MARKED ■ ARE INTEGRAL TO THE VALVE.
- 4...JUNCTION BOX WILL BE INTEGRAL TO ACTUATOR.
- 5...ISOLATION VALVE SHALL BE INSTALLED CLOSE TO THE VALVE ASSEMBLY.

**PNEUMATIC SOV HOOK UP SCHEME**

|          |         |       |             |      |          |
|----------|---------|-------|-------------|------|----------|
| APPROVED | CHECKED | DRAWN | DESCRIPTION | REV. | DATE     |
| GP       | AT      | SD    |             | 0    | 21.04.10 |

TYPICAL INSTRUMENT INSTALLATION DIAGRAM  
 1x800MW SUPER CRITICAL THERMAL POWER PROJECT  
 (UNIT #8 AT WAMAKRON THERMAL POWER STATION, GUJARAT)  
 GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
 VADODARA, GUJARAT

DEVELOPMENT CONSULTANTS PVT. LTD.  
 CONSULTING ENGINEERS  
 KOLKATA · MUMBAI · CHENNAI · NEW DELHI

JOB NO. DGPL-K9213R SCALE NIL SH. 20 OF 20  
 DWG. NO. K9213R-DWG-I-0060 REV. 0

PRELIMINARY  
 TENDER PURPOSE ONLY



**TITLE:**  
**1X800 MW WANAKBORI STPP**  
**TECHNICAL SPECIFICATION FOR**  
**CONDENSATE POLISHING UNIT**

SPECIFICATION NO.: PE-TS-408-155-A001

VOLUME II-B

SECTION -C

REV. NO. 00

## ANNEXURES



**TITLE:**  
**1X800 MW WANAKBORI STPP**  
**TECHNICAL SPECIFICATION FOR**  
**CONDENSATE POLISHING UNIT**

SPECIFICATION NO.: PE-TS-408-155-A001

VOLUME II-B

SECTION -C

REV. NO. 00

## **ANNEXURE-I**

### **LIST OF MAKES OF SUB-VENDOR ITEMS**



**TITLE:**  
**1X800 MW WANAKBORI STPP**  
**TECHNICAL SPECIFICATION FOR**  
**CONDENSATE POLISHING UNIT**

SPECIFICATION NO.: PE-TS-408-155-A001

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SECTION -C

REV. NO. 00

**APPROVED SUB VENDOR LIST FOR MECHANICAL ITEMS**

| SR. NO. | DETAILS OF EQUIPMENT/SYSTEM                               | FINAL APPROVED VENDOR  |
|---------|---|--|
|         | <b>MECHANICAL</b>   |  |
| 1.      | Water Pumps   | WORTHINGTON,MATHER & PLATT, KIRLOSKAR, KSB , MAX FLOW, FLOWMORE, SAM, BEACON WEIR LTD; AKAY, SULZER PUMPS INDIA LTD; VOLTAS, JYOTI LTD; FLOWSERVE INDIA CONTROLS PVT LTD.  |
| 2.      | Disposal Pumps  | INDURE, SAM, WEIR,KISHORE PUMPS  |
| 3.      | Sump Pumps / Submersible Pumps                            | FLOWMORE PVT.LTD; KIRLOSKAR BROS. LTD; KSB PUMPS LTD; KISHOR PUMPS PVT.LTD; SU MOTORS,JYOTI PVT.LTD; WPIL LIMITED, BEACON WEIR LIMITED, SAM TURBO, HYD IND.  |
| 4.      | LubeOil Pumps(Centrifugal)                                | KSB-PUNE, KIRLOSKAR EBARA-KIRLOSKARWADI, SULZER-MUMBAI   |
| 5.      | Lube Oil Pumps (Screw Type)                               | ALLWEILER-GERMANY, IMO PUMP-USA, TUSHACO DAMAN, LEISTRITZ (EMPIRE)-GERMANY   |
| 6.      | Jacking Oil Pump  | TUSHACO, (DELTA CORP)-DAMAN / VAPI, HAGULLAND DENSSION-HYDERABAD   |
| 7.      | Jacking Oil Pumps With Motor (Screw Type)                 | TUSHACO PUMPS LTD. MUMBAI, ALLWEILER AG GERMANY, SIEMENS / KWU-GERMANY   |
| 8.      | Aux. Oil Pump & Emergency Oil Pump With Motor (AOP & EOP) | KSB-PUNE, MATHER & PLATT-PUNE, KBL-PUNE, BUFFALO-USA, KIRLOSKAR, GE-USA  |
| 9.      | Main & Aux. Hydraulic Pumps                               | HARTMAN CONTROLS INC.- USA, GE-USA, DELTA CORP.-INDIA  |
| 10.     | Vacuum Pumps  | BOC EDWARDS HICK HARGIRES-UK, NI-TECH INC. USA/FLOWTECH SOUTH AFRICA, STERLING SIHI GMBH-GERMANY, D.H.BUDENBERG LTD. UK, TRAN SCAT-USA,TRAN SCAT-USA, PPI, KAKATI / VACUNAIR / GARDNER / NASH ELMO INDUSTRIES GMBH, GERMANY / UNIQUE SYSTEMS INC., USA |
| 11.     | Boiler feed water pumps                                   | K S B, KIRLOSKAR EBARA, SULZER ,INGERSOLL RAND, TORISHIMA,WEIR PUMPS/ BHEL (INCOLLABORATION WITH MHI), CLYDE UNION PUMPS INDIA.  |
| 12.     | Condensate Extraction Pumps                               | KIRLOSKAR EBARA, KSB, SULZER PUMPS, WEIR PUMPS / TORISHIMA / CHANGSHA/ BHEL (INCOLLABORATION WITH MHI)   |
| 13.     | Concrete Volute   | KIRLOSKAR  |
| 14.     | General Service Pump                                      | SULZER PUMP, SAM TURBO LTD; KSB PUMPS, KIRLOSKAR, VOLTAS   |
| 15.     | GATE/GLOBE/ CHECK VALVES                                  |  |
|         | (A) Cast Steel Valves                                     | FOURESS, L&T, LEADER, SAKHI,MACNEILL, MAGORE, CRESENT, GEETA , KBL, AV VALVE BOSS, AUDCO   |
|         | (B) Forged Steel Valves                                   | AUDCO, FOURESS, LEADER , KSB, BDK,HI -TECH, L&T  |
|         | (C) Cast Iron Valves                                      | FOURESS/ L&T/KIRLOSKAR/BDK/LEADER/AV ENGG./VAAS/GALAXY/HAWA VALVES/LEVCON/BANKIM/I.M.ENGINEERS/H.SARKAR/AUDCO/ SHIVA DURGA/UPADHYAY VALVES/ CRESCENT /   |



**TITLE:**  
**1X800 MW WANAKBORI STPP**  
**TECHNICAL SPECIFICATION FOR**  
**CONDENSATE POLISHING UNIT**

SPECIFICATION NO.: PE-TS-408-155-A001

VOLUME II-B

SECTION -C

REV. NO. 00

| SR. NO. | DETAILS OF EQUIPMENT/SYSTEM  | FINAL APPROVED VENDOR   |
|---------|--|---|
|         |  | OSCAR / AV VALVES/ SELTTEC/ GEETA/ IMET/ BOSS/LEADER VALVE  |
|         | (D) G. M.Valves  | LEADER / BOMBAY METAL / SANT / A.V. VALVES / GG / BDK/ AUDCO/ VAAS/ ILK / MIL/ FOURESS / JASH SCHUTTE   |
|         | (E) Slewing Ring Bearing   | FAG/SKF/ROTHERDE  |
|         | (F) Bronze   | LEADER, IMET, AV ENGG., BOSS  |
|         | (G) Dual Plate Check Valve   | ADVANCE, AUDCO, UPADHYAY, C&R, L&T  |
|         | (H) General (As Above)   | SHANCO,BDK,H SARKAR,GALAXY, L&T   |
| 16.     | Needle Valve   | LEADER, AV ENGG. , BLUE STAR , BLISS ANAND,CRESENT, AKSONS, BDK, FLUID LINE   |
| 17.     | Ball Valves  | AKSONS, AKAY, CRESENT, BDK, FLUID LINE, AUDCO,KIRLOSKAR,LEADER VALVES,KSB PUMPS, L&T  |
| 18.     | Safety Valves  | BLISS, ANAND, FIBRE, FALNGER, LEADER, SARAIN , JN MASHALL, L&T, TYCO SANMAR LTD; FOURERS ENGG; BHEL-TRICHY  |
| 19.     | Vent Cocks/Valves  | AV ENGG. , LEADER, GALAXY   |
| 20.     | Plug Valve   | AUDCO, LEADER, IMET, DEZURIK  |
| 21.     | Butterfly Valve  | FOURESS,GEETA,FLOVEL,L&T,CRESCENT,IL(PALGHAT),BARO DA FLOWTECH,AUDCO,ADVANCE,KIRLOSKAR,TYCO,KEYSTONE, MIL,FISHER SAN MAR,ISTRUMENTATION LTD,Sub vender -- CRANE PROCESS,BDK   |
| 22.     | Knife Gate Valve   | DEZURIK, FOURESS  |
| 23.     | Control Valve/Flow Elements  | MILCONTROLS,FOURESS,FISHER,XOMAX,AVCON,BLUESTAR, MASONEILEN,MICRO PRECISION,TECHNOMATIC,DIATRIECH STANDARD,(IL,PALGHAT FOR DIAGNOSTIC AND PROGRAMMING STATION AND SPECIAL LAB INSTRUMENTS.),SANMAN,CCI,SULZER,DRESSER,ABB ,INSTRUMENTATION LIMITED,FORBES MARSHALL ARCA |
| 24.     | BFP RC Control Value   | MASONEILAN (DRESSER)-FRANCE, CONTROL COMPONENTS INC-USA   |
| 25.     | Suction Strainers (BFP, BP & CEP)  | OTOKLIN- MUMBAI, MULTITEX-NEW DELHI, GUJARATH OTOFILT-AHMEDABAD   |
| 26.     | Actuators (For BF Valves)  | ROTORK CONTROLS (INDIA) LTD. CHENNAI, AUMA (INDIA) LTD. BANGALORE, MARSH ENGINEERS PUNE, LIMITORQUE INDIA LTD. DELHI  |
| 27.     | Solenoid Valves  | AVCON,ROTEX,ASCO,HERION,SIETZ,ADVANCE,BLUE STAR,NUCON,VELJAN HYDRAIR,SMC PNEUMATIC  |
| 28.     | Drain Valve  | SEMPEELL AG-GERMANY, REINEKE-GERMANY,INSTRUMENTATION LTD  |
| 29.     | Valves(Gate, Globe, NRV), Flanges(LP Heaters,Miscellaneous Tanks,Gland Steam Condenser | LEADER VALVES, BHEL, AUDCO VALVES, KSB,SAMPELL,DREWANCE MICON AND FOURESS   |



**TITLE:**  
**1X800 MW WANAKBORI STPP**  
**TECHNICAL SPECIFICATION FOR**  
**CONDENSATE POLISHING UNIT**

SPECIFICATION NO.: PE-TS-408-155-A001

VOLUME II-B

SECTION –C

REV. NO. 00

| <b>SR. NO.</b> | <b>DETAILS OF EQUIPMENT/SYSTEM</b>    | <b>FINAL APPROVED VENDOR</b>   |
|----------------|---------------------------------------|--|
| 30.            | Valves & Specialties                  | AUDCO;SEMPELL;JNM;KSB;CRESENT;BDK;FOURESS;GEA;ME SOLINE(FRANCE), L&T   |
| 31.            | Lifting Beam                          | INDO ASIATIC ENGINEER PVT.LTD.DELHI,STANDARD CASTING PVT.LTD DELHI,GROWTH SHOP TISCO-JAMSHEDPUR,UNITECH MACHINES SAHARANPUR        |
| 32.            | MS Pipes / ERW(Black And Galvanized)  | ITC, SURYA ROSHNI, ZENITH, INDUS ,MAHARASHTRA TUBES, JINDAL, SAIL, AJANTA, HSL,GST,BST, JAIN TUBES, TATA, MAN INDUSTRIES,RATNAMANI |
| 33.            | CI Pipes                              | IISCO, ELECTRO STEEL   |
| 34.            | Seamless Carbon Steel Pipes           | MAHARASHTRA SEAM LESS, ISMT, KALYANI, INDUS, TATA, SAIL,RATNAMANI  |
| 35.            | Carbon Steel Pipes And Fittings       | MS FITTINGS,TRUTE FORGE,NITIN,ABASI,PARAMOUNT FORGE,ITC,SAIL,SURYA ROSHNI,RATNAMANI  |
| 36.            | Forge Steel Pipes And Fittings.       | NITIN,TRUTEFORGE,TUBE PRODUCTS   |
| 37.            | Stainless Steel Pipes                 | JINDAL, RATNAMANI, REMI  |
| 38.            | Turbine Integral Piping               | BEND JOINTS-BHOPAL, UNITECH-SAHARANPUR,BHEL PIPING CENTRE-CHENNAI, DARSHINIENTERPRISE-YAMU NANAGAR                                 |
| 39.            | CPVC Pipes ,Valves And Fittings       | GEORGE FISHER , ASTRAL   |
| 40.            | Pipe Flanges / Companion Flanges      | TRUTE FORGE, PERFECT, SIVANANDA, PUNJAB STEEL WORKS, ABASI , HI ENGINEERS , MS FITTINGS  |
| 41.            | Bolt And Nuts                         | TATA,JK,PRECISION , GMW, UNBRAKO   |
| 42.            | Gaskets                               | CHAMPION, GASKET INDIA,MECH PACKING, INMARCO, PERMANITE, HINDUSTAN FERRODO   |
| 43.            | Spring Hangers And Hangers Components | SARATHI,MYRICKS,PIPING AND ENERGY PRODUCT/ PIPE HANGERS & SUPPORT PVT LTD  |
| 44.            | Bearings                              | SKF , FAG, NTN , NBC , NORMA , KINGSBURRY,TIMKEN, TATA,COOPER, INA   |
| 45.            | Journal Bearing BFP & BP              | COLHERENE-UK, WAUKESHA BEARINGS (GLACIER) UK, MITCHELL- UK, MITCHELL INDIA- BANGALORE  |
| 46.            | Thrust Cum Journal Bearing For CEP    | WAUKESHA BEARINGS (GLACIER)- UK, MITCHELL-UK, MITCHELL INDIA-BANGALORE   |
| 47.            | Thrust Bearing (BFP & BP)             | WAUKESHA BEARINGS (GLACIER)-UK, MITCHELL-UK, MITCHELL INDIA- BANGALORE, KINGSBURY-USA  |
| 48.            | Mechanical Seal (BFP)                 | BURGMANN-GERMANY, BURGMANN-INDIA (PO ON BURGMANN INDIA & SEALS MANUFACTURED BY BURGMANN-GERMANY),Dura metalic                      |
| 49.            | Thrust Cum Journal Bearing For CWP    | MITCHELL INDIA-BANGALORE,OMEGA   |
| 50.            | Mechanical Seal (BP & CEP)            | BURGMANN INDIA , EAGLE POONAWALA LTD.(FORMELY SEALOL HINDUSTAN)-PUNE, FLOWERVE SANMAR (FORMERLY DURAMETTALIC) CHENNAI              |



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| SR. NO. | DETAILS OF EQUIPMENT/SYSTEM                   | FINAL APPROVED VENDOR   |
|---------|---|---|
| 51.     | Gear Box                                      | RADICON, ELECON, FMG, NAW, KIRLOSKAR, SHANTHI GEARS, GREAVES, FLENDER, SEW, CYCLO TRANS; NEW ALLENBERY, WALCHAND NAGAR-PUNE, RENK AG-GERMANY, LUFKIN-USA/FRANCE, FLENDER GRAFFENSTADEN-FRANCE, BHS-GERMANY, TRIVENI ENGG, MYSORE                  |
| 52.     | Planetary Gear Box                            | M/S FLENDER, GERMAN COLOBORATION MANUFACTURED IN INDIA  |
| 53.     | Belt Vulcanising Machine                      | NILOS INDIA / S V DATTAR/CHANDRA & CHANDRA  |
| 54.     | Wire Ropes                                    | USHA MARTIN, BOMBAY WIRE, UNITED WIRE   |
| 55.     | "Y" Strainer                                  | GREAVE COTTON, LEADER, BLISS ANAND, JAYPEE, MACNEILL MAGORE   |
| 56.     | Air Blower                                    | MANEKLAL, KAY ENGG., INDCON, C-DOCTOR   |
| 57.     | Site Flow Indicator                           | GREAVES COTTON, LEADER, MACMEIL, AV ENGG., LEVCON, AUTOMAT, ROTA INSTRUMENTS, EUREKA, FORBES MARSHALL, TRAC   |
| 58.     | Air Heater                                    | ESCORTS, LAMDA INDUSTRIES, Patel Airtemp (India) Ltd  |
| 59.     | Expansion Joints(Rubber)                      | D WREN, FLEXICON LIMITED, Keld Ellentoft India Pvt Ltd .Madras  |
| 60.     | Expansion Joints(Steel)                       | SUR, MB EXPANSIONS, FLY IDYNE, EXPANSION JOINT SYSTEMS INC. USA   |
| 61.     | Painting Materials                            | BERGER, SHALIMAR, ASIAN PAINTS, NEROLAC, JHONSON AND NICHOLSON, AKZO NOBEL  |
| 62.     | Under Ground Coating Material                 | SHALIMAR TAR PRODUCTS, PYPKOTE, KIRLOSKAR   |
| 63.     | Corrocoat Painting And Application            | KIRLOSKAR   |
| 64.     | Thermal Insulating Materials With Accessories | LLOYDS, ROCK WOOL, EXCLITE  |
| 65.     | Compressors/Compressed air system             | KG KHOSLA, KIRLOSKAR, ELGI, CONSOLIDATED PNEUMATIC, INGERSOL, ATLAS COPCO, CHICAGO PNEUMATIC, DOCTOR AND COMPANY PVT. LTD, COIMBATORE, PATEL AIRTEMP (INDIA) LTD, RAKANPUR, VEESONS ENERGY SYSTEM PVT. LTD, TIRUCHY                               |
| 66.     | Air Drying Plant                              | PACE, SABROE, ULTRATROC, INDCON, DHIR PNEUMATIC, MELLCON, ELGI / INGESOLL RAND / KG KHOSLA/ CONSOLIDATED PNEUMATIC/ CHICAGO/DELAIR, TRIDENT,  |
| 67.     | Pressure Vessels, Tanks, Air Receivers.       | SV ENGG., PRAGATI ENGG., TEXMACO, ANUP, KANARA, VISHWAKARMA, SATGURU, VIRAT TRANS, HEAT TRANSFER, VIJAY FAB, BINNY ENG. LTD; TECHNOFAB, GMW, RAUNAQ   |
| 68.     | Misc. Tanks                                   | GENERAL MECHANICAL WORKS, SAKTHI HI-TECH CONSTRUCTIONS PVT.LTD; TECHNOFAB ENGG.LTD; UNITECH MACHINES LTD; THERMOPADS PVT LIMITED, PAL ENGG. CORPORATION UNITECH MACHINES LTD. TECHNO ELECTRIC & ENGG. CO. LTD. VIJAY TANKS & VESSELS LTD., BARODA |



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|----------------|---|--|
| 69.            | Air Pressure Regulator  | SHAVO NORGREN , PLACKA,JRU INSTRUMENTS (EARLIER PLACKA),CHENNAI  |
| 70.            | Oil Lubricator  | SHAVO NORGREN , PLACKA   |
| 71.            | Duplex Oil Filter (Lub Oil)   | BOLL & KIRCH FILTERBAU GMBH- GERMANY, HYDAC FILTER TECHNIC- GERMANY, K&H EPPENSTEINER GERMANY, EPE EPPENSTIENER- GERMANY, INTERNORMAN FILTER-MUMBAI  |
| 72.            | Duplex Filter (Jacking Oil)   | EPE EPPENSTIENER- GERMANY, HYDAC- GERMANY, K&H EPPENSTEINER- GERMANY   |
| 73.            | Oil Purification Unit (Oil Centrifuge)                                      | ALFA LEVAL INDIA LTD. PUNE, WEST FALLIA SEPERATOR INDIA PVT.LTD; SERVIZI- ITALY, PENNWALT INDIA LTD. INDIA,WESTFALLIA SEPERATOR, INDIA / SERVIZE ITALY   |
| 74.            | Damper (Viscous)  | DAMPER (VISCOUS),Pennwalt India Ltd. India   |
| 75.            | LP By Pass System Including LP By Pass Valve, Hydraulic Spray Valve & H PSU | BOSCH REXROTH- GERMANY, WELL AND TUXHORN GERMANY, CCI- SWITZERLAND, BOMAFA GERMANY, BOPP & REUTHER- GERMANY,HORA,BOSCH REXROTH- GERMANY, WELL AND TUXHORN GERMANY, CCI- SWITZERLAND, BOMAFA GERMANY, BOPP & REUTHER- GERMANY |
| 76.            | H2 Gas Analyzer Cabinet   | ABB LTD BANGALORE,SIEMENS-INDIA,YOKOGAWA- BANGALORE,HONEYWELL AUTOMATION- PUNE,CHEMTROLL- MUMBAI   |
| 77.            | Welded Austenitic Tubes (For Condenser)                                     | CST VALINOX HYDERABAD, SCHOELLER WERK GMBH & CO. GERMANY, RATNAMANI- AHMEDABAD, VALTIMET-FRANCE  |
| 78.            | Pre Filter /After Filter InCompressed Air System                            | FINE FILTERS,Rotex,Shavo Norgen, Mumbai  |
| 79.            | Filters   | HILLARD-USA, MICROFLO FILTERS, MULTITEX-INDIA  |
| 80.            | Heating Elements  | ESCORTS , RACOLD   |
| 81.            | Heat Exchanger  | KPC,HEAT TRANS,EAGLE,BEAM  |
| 82.            | Heat Exchangers (Plate Type)  | ALFA LAVAL (INDIA) LTD; TRANTER INDIA PRIVATE LIMITED-PUNE, GEA ECOFLEX INDIA PVT LTD; IDMC ANAND, GEI   |
| 83.            | Auto Drain Valve In Air Circuit   | ULTRAFILTER,GREAVES  |
| 84.            | Mechanical Exhauster  | NASH, SIEMENS,NI-TECH INC.USA  |
| 85.            | Ceramic Liners  | NTB HITECH   |
| 86.            | Handling Equipment: Elec. Operated  | UNIVERSAL HOIST-O- FABRIK, CONSOLIDATED HOISTS PVT. LTD; ARMSEL MHE PVT. LTD; DYNAMMECH CRANES PVT. LTD; LIFTING EQUIPMENTS & ACCESSORIES, POWER BUILT PVT. LTD. V.V. NAGAR  |
| 87.            | Handling Equipment- Mechanical  | LIFTING EQUIPMENTS &ACCESSORIES,UNIVERSAL HOIST-O- FABRIK,ARMSEL MHE PVT.LTD   |



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|---------|---|---|
| 88.     | Chain Pulley Block  | HERCULES HOISTS LTD; LIFTING EQUIPMENTS & ACCESSORIES, CONSOLIDTED HOIST PVT LTD;BEMCO PVT LTD<br>TUOBRO FURGUSON(INDIA)PVT.LTD; GRIP ENGRS; TRANSPADE, GREAVES, , UNIVERSAL HOIST, ARMSEL, POWER BUILD, AVON CRANE,WMI   |
| 89.     | Electric Hoists   | AVON CRANES PVT.LTD; HERCULES HOISTS LTD; EDDYCRANES PVT.LTD; LIFTING EQUIPMENTS & ACCESSORIES, REVA INDUSTRIES LTD; CONSOLIDTED HOIST PVT LTD; TUOBRO FURGUSON(INDIA)PVT.LTD; GRIP ENGRS; TRANSPADE, GREAVES, INDEF, UNIVERSAL HOIST, ARMSEL, POWER BUILD, TRACTEL TIRFOR  |
| 90.     | Double Girder EOT Cranes Upto 50t ( CWPH & Other Areas)             | FURNACE&FOUNDRY EQUIPMENT CO; WMI CRANES LTD;THE TATA IRON & STEEL CO.LTD; UNIQUE INDUSTRIAL HANDLERS PVT.LTD; MUKAND LIMITED, ANUPAM INDUSTRIES LTD; AVON CRANES PVT.LTD; REVA INDUSTRIES LTD, HEAVY ENGG. CORPORATION LTD.<br>ALPHA SERVICES ARMSEL MHE PVT. LTD.,BANGALORE CENTURY CRANE ENGINEERS PVT. LTD. CRANEX LIMITED,NEW DELHI; DEMAG CRANES & COMPONENTS (I) PVT. LTD. |
| 91.     | Single Girder HOT/EOT Cranes  | CONSOLIDTED HOIST PVT LTD; LIFTING EQUIPMENTS & ACCESSORIES, REVA INDUSTRIES LTD.,ALPHA SERVICES,GARLICK, BATLIBOI, KHANDLWAL, REWA, VIDYUT,GREAVES, CHITRAM, CRANEX, ACME, WMI,UNIQUE, ANUPAM INDUSTRIES LTD,THE TATA IRON & STEEL CO.LTD,FURNACE & FOUNDRY EQUIPMENT CO,MUKAND LIMITED  |
| 92.     | Double Girder EOT Crane Above 50t To 150t (TG/GT Hall & Other Areas | ANUPAM INDUSTRIES LTD; FURNACE & FOUNDRY EQUIPMENT CO; MUKAND LIMITED, THE TATA IRON & STEEL CO.LTD; UNIQUE INDUSTRIAL HANDLERS PVT.LTD; WMI CRANES LTD,REVA INDUSTRIES LTD.,HEAVY ENGG. CORPORATION LTD.   |
| 93.     | Fire Protection System  | KIDDE INDIA LIMITED ,MUMBAI, NEW FIREENGINEERS PVT.LTD; UNITECH MACHINES LTD;WORMALD FIRE SYSTEMS, GENERAL MECHANICALWORKS, MEHTA & ASSOCIATES FIRE PROTECTIONSYSTEM PVT. LTD. AHMEDABAD, TECHNOFAB ,AGNICE / FIRE PRO / NEW FIRE /TYCO / STEELAGE/ VIJAY/MATHER & PLTT/ MINIMAX/ KUVVERJI DEVSI/PAVLO MARINE, UTC FIRE & SECURITY INDIA LTD.                                     |
| 94.     | A/C System  | ASEA BROWN BOVERI LTD; BLUE STAR LTD; VOLTAS LTD., CARRIER AIRCON/CARRIER/ FRICK INDIA,STERLING AND WILSON PRIVATE LIMITED,   |
| 95.     | Ventilation System  | ASEA BROWN BOVERI LTD; AIR LINK ENGINEERS PVT.LTD; ALSTOM LTD; BLUE STAR LTD; C.DOCTOR & CO.PVT.LTD; HYDERABAD POLLUTION CONTROLS LTD; VOLTAS LTD; APC SYSTEM,SK SYSTEMS PRIVATE LIMITED,KONDLI,ROOTS COOLING SYSTEMS PVT.LTD ,M/s Draft Air Pvt Ltd. .   |
| 96.     | Ventilation Fan   | INDUSTRIAL FAN, C DOCTOR, DUVENT, KIRLOSKAR   |



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|---------|--|--|
|         |  | AAF, PATEL AIR TEMP  |
| 97.     | Portable Fire Extinguishers                | VIJAY, LIGHTEX, SAFEX  |
| 98.     | Infra Red Detectors                        | NEOLA  |
| 99.     | Breathing Apparatus                        | IMPORTED , FENZI, SAKURA   |
| 100.    | Membrane                                   | DOW, KOTCH   |
| 101.    | Oil System/Lube Oil System                 | INSTRUMENTATION LTD; MIL CONTROLS LIMITED, R.K.CONTROL INSTRUMENTS PVT.LTD; SAMSON CONTROLS PRIVATE LIMITED, SOUTHERN LUBRICANTS-BANGALORE, PRAKASH LUB EQPTS- CALCUTTA, LEONARD ENGG. PVT KTD. BANGALORE, POWERMAX-CHENNAI, LINCOLN HELIOS-BANGALORE, T.A HYDRAULICS HYDERABAD, HYDROPOWER CORPO; UNITY |
| 102.    | SB Pr. Reducing Valve & Control Valve : HP | INSTRUMENTATION LTD; MIL CONTROLS LIMITED, FISHER SANMAR LIMITED, DRESSER VALVE INDIA PRIVATE LTD  |
| 103.    | Pump:Fuel Oil Pump                         | TUSHACO PUMPS PVT.LTD; U.T.PUMPS & SYSTEMS LTD; ALEKTON ENGG.INDUSTRIES P.LTD; JOH HEINRICH BORNEMANN GMBH & CO KG, HEATLY & GRAHAM, MATZ PUMPS  |
| 104.    | BCWP                                       | KSB AKTIENGESELLSCHAFT, TORISHIMA PUMP MFG CO.LTD; HAYWARD TYLER LTD; SAM PUMPS, FLOW MORE   |
| 105.    | Elevator-Passenger & Goods                 | KONE ELEVATOR INDIA PVT.LTD; OTIS ELEVATOR CO (I) LTD; ORBIS ELEVATOR AHMEDABAD, TECHNO ELEVATOR AHMEDABAD; JOHNSON LIFTS PRIVATE LIMITED.   |
| 106.    | Actuator:Pneumatic(OP/C L)                 | KELTRON CONTROLS, INSTRUMENTATION LTD.,FORBES MARSHALL,FOURESS   |
| 107.    | Wagon Tippler                              | ELECON/L&T/TRF/KRUPP, INDIA/METSO MINERALS/TKII  |
| 108.    | Apron Feeder                               | KRUPP - INDIA / ELECON / TRF / L&T/MBE   |
| 109.    | Crusher ( Ring Granulator)                 | KRUPP, INDIA, / ELECON / TRF / L&T / MBE/ SAYAJI/ MPSI-USA/ TRF  |
| 110.    | Belt Conv. (Idlers, Pulleys)               | L&T/ ELECON / TRF / MBE / KALI MATERIAL HANDLING SYSTEM / RADIANT/KRUPP INDIA/   |
| 111.    | Belting Nylon                              | NORTHLAND / PHOENIX - YULE / HILTON / ORIENTAL /MRF / NIRLON LTD. / HINDUSTAN RUBBER/NRC   |
| 112.    | Vibrating Grizzly Feeder / Roller Screen   | KRUPP - INDIA / ELECON / TRF / L&T /MBE  |
| 113.    | Stacker Reclaimer                          | ELECON/TRF/KRUPP/L&T/MBE/ FLSMIDTH / METSO MINERALS  |
| 114.    | Travelling Tripper                         | ELECON / TRF / KRUPP / L&T / MBE   |



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|----------------|---|--|
| 115.           | Belt Weigher  | POWER BUILD/JENSON & NICHOLSON / TRANSWEIGH/AVERY/ENACARDIORITE/IPA  |
| 116.           | Magnetic Separators Foreign Metal Picker & Detector | POWER BUILD/ELECTROMAG/MAGNETIC CORPORATION OF INDIA/WMI   |
| 117.           | Dust Suppression System                             | APC / KAVERI/F.HARLEY & CO/PREMIER ENVIROMENTAL/BHEL/EAGLE AGRO TECH IND/DUVENT/ BATLIBOI/ DUSTVEN   |
| 118.           | Fluid Coupling/Scoop Type Coupling                  | PEMBRIL / FLU IDOMAT /VOITH INDIA / ELECON   |
| 119.           | Belt Cleaner  | TECHNO - FAB /HOSCH EQUIPMENT INDIA (HEIPL) / KAVERI / THEJO ENGRS. / SCORPIO/ SPILLBAN/ELECON   |
| 120.           | Thrustor Brakes                                     | BUBENZER/ EMCO PRECIMA/ SIEGERLAND BREMSEN/ SIEMA STROMAG/ KATEEL ENGG./ TECHNO CRATS/ ELECTROMAG  |
| 121.           | Vibration Isolation System                          | GERB,INSTRUMENTATION ENGINEERS PRIVATE LIMITED   |
| 122.           | Hyd. Power Pack For Stacker Reclaimer               | REXORTH/ L&T KOMATSU/VICKERS SYSTEM  |
| 123.           | Hyd. Cylinders                                      | WIPRO/VEZJAN/EIMCO   |
| 124.           | Hyd. Cylinders                                      | VOITH TURBO-GERMANY, VOITH TURBO PVT LTD. HYDERABAD  |
| 125.           | Connecting Coupling For MD BFP Set & CEP            | FLEXIBOX LTD. UK, TURBOFLEX-UK, EUROFLEX-UK, EUROFLEX TRANSMISSION LTD.HYDERABAD   |
| 126.           | Connecting Coupling For CWP                         | EUROFLEX TRANSMISSION LTD. HYDERABAD, TRIVENI FLEXI BOX -BANGALORE, UNIQUE TRANSMISSION-KOLKATA  |
| 127.           | Connecting Coupling (Membrane Type)                 | EUROFLEX TRANSMISSION-HYDERABAD, RENK AG GERMANY, JOHN CRANE-UK, KOPFLEX-USA, BIBBY TURBOFLEX (FORMERLY EUROFLEX)-UK, AMERIDRIVES (ZURN)-USA |
| 128.           | Connecting Coupling (Gear Type)                     | FLENDER GRAFFENSTADEN-FRANCE, RENK AG GERMANY, LUFKIN- USA/FRANCE, BHS-GERMANY   |
| 129.           | Disconnecting Coupling                              | ZURN INC-USA   |
| 130.           | ERW Pipes   | JINDAL/SURYA ROSHNI/SAIL/ISSCO   |
| 131.           | Bearing For Idlers And Pulleys                      | SKF/FAG/TATA/ABL/NEI(NBC)/M/S cooper   |
| 132.           | Pipes For Idlers                                    | ZENITH/ SURYA ROSHNI/JINDAL/GOOD LUCK STEEL,TATA   |



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|----------------|-------------------------------------|---|
| 133.           | Mill Handling System                | CONSOLIDATED HOIST-PUNE/ ARMSEL MHE PVT. LTD.BANGALORE/ UNIVERSAL HOIST-O-FABRIK MUMBAI/ DYNAMECH CRANES PVT. LTD. MUMBAI --- Aslo as per Sr no 86,92   |
| 134.           | Grinding Roll                       | AIA ENGINEERING, AHMEDABAD,MAGOTTEAUX INDUSTRIES  |
| 135.           | Bull Ring Segments                  | AIA ENGINEERING, AHMEDABAD,BHEL HYDERABAD   |
| 136.           | Inner Cone                          | BHEL EPD- BANGALORE, BHEL IP-JAGDISHPUR   |
| 137.           | Air Cylinder                        | VELJAN HYDRAIR-HYDERABAD, NUCON INDUSTRIES HYDERABAD, PRECISION ENGG (PREAC) BANGALORE, SALZG ITTER HYRAU LICS-HYD ERABAD, ASCO-CHENNAI   |
| 138.           | Travelling Water Screens            | GENERAL MECHANICAL WORKS, MACMET INDIA LTD, VOLTAS  |
| 139.           | Self Cleaning/Debris Filter         | EIMCO WATER TECHNOLOGIES –LLC- USA, FILTRATION ENGINEERS (I) PVT.LTD; TAPROGGE GMBH, MULTITEX FILTRATION ENGINEERS LTD,GEA BGR ENERGY SYSTEM INDIA LTD  |
| 140.           | CO2 Fire Protection                 | NEW FIRE ENG; NITIN IND; AGNI   |
| 141.           | Inlet Ducting                       | PVK ENG; INDIRA IND; LIOYDS INSULATION  |
| 142.           | Sub-Vendors for Cement              | NARMADA CEMENT COMPANY, GUJARAT AMBUJA CEMENT CO. LTD. , SAURASHTRA CEMENT & CHEMICALS , SIDDHI CEMENT , J.K.CEMENT , L&T CEMENT (ULTRATECH) , SHRI DIGVIJAYA CEMENT CO. LTD. , BINANI CEMENT , , VIKRAM CEMENT , , SANGHI CEMENT , , LAXMI CEMENT  |
| 143.           | Sub-Vendors for Steel               | STEEL AUTHORITY OF INDIA , TATA IRON & STEEL CO. LTD; JINDAL, LLOYDS, ESSAR STEEL LTD; ISPAT, SHAH ALLOYS LTD. AHMEDABAD, MAHAVIR ROLLING MILLS LTD. AHMEDABAD, BHUWALKA STEEL IND. MUMBAI, SUN VIJAY ROLLING AND ENGINEERING LTD. NAGPUR, SHRI BAJRANG ALLOYS LTD. RAIPUR, UNIQUE STRUCTURES AND TOWERS LTD. RAIPUR, ISSCO |
| 144.           | Desuperheater                       | ILP, FISHER SANMAR  |
| 145.           | REFRACTORY                          | ACE REFRACTORIES / DALMIYA REFRACTORIES,Associated Cement Company Limited, Katni  |
| 146.           | LUB OIL TRANSFER PUMPS              | UT PUMPS & SYSTEMS LTD.,MATZ PUMPS PVT.LTD.,TUSHACO PUMPS PVT.LTD   |
| 147.           | FIRE TENDER & EQUIPMENTS            | STEELAGE INDUSTRIES LTD. / VIJAY FIRE VEHICLES AND PUMPS LTD./WADIA BODY BUILDERS   |
| 148.           | THERMAL INSULATION OF STEAM TURBINE | LLOYD INSULATIONS, INDIA; MIN WOOL, INDIA; KAEFER PUNJ LLOYD, THERMOCARE ROCKWOOL PVT. LTD.   |
| 149.           | WELDED AUSTENTIC                    | SCHOELLER WERKE GMBH & CO,GERMANY,MULTITEX  |



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|---------|---|---|
|         | TUBES ( FOR CONDENSER)                          | FILTRATION ENGINEERS LTD.,CST, Valinox, Hyderabad,Manish udhyog haridwar  |
| 150.    | Civil construction                              | M/s J K Construction,M/s BJCL,M/s Shriram engineering Construction,M/s TIPL, M/s Gammon India Ltd,M/s Simplex Infrastructures Ltd.,GERB VIBRATION CONTROL SYSTEMS PVT LIMITED |
| 151.    | FABRICATION & ERECTION OFSTRUCTURAL STEEL WORKS | Petron civil Engineering limitrd,L & T ECC,Ramky ifracture,M/s Sunil Hi Tech  |
| 152.    | GRATINGS , PLATFORMS & HANDRAILS                | Indiana Gratings Pvt. Ltd., India,Galfan Engineers Pvt. Ltd., India,Kande Anand Udyog, India,Greatweld Steel Grating Pvt. Ltd., India ,GMW VADODARA.                          |
| 153.    | Boiler & Auxiliaries Erection                   | M/s Sunil Hi Tech, M/s Karpara Engg, M/s Power Mech Pvt.Ltd,Tata Projects, M/s TPS Builders Limited,L&T-ECC, Dowel erectors, M/s Petron Engineering Construction Ltd. India.  |
| 154.    | TG & Auxiliaries Erection                       | M/s Indwell Engg,M/s Power Mech,L&T- ECC,M/s Universal erection,M/s Alpha Power Engg. Service Pvt.Ltd   |

**Note: Make of any other equipments / item / components not specified in the above list shall be subject to the approval of BHEL/Customer during detailed engineering stage without any price and delivery implication to BHEL. For Additional sub vendor bidder shall submit the credentials of these sub vendors in the attached format Annexure –A.**



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| SR. NO. | DETAILS OF EQUIPMENT/SYSTEM                 | FINAL APPROVED VENDOR  |
|---------|---|--|
|         | <b>ELECTRICAL</b>                           |  |
| 1       | Protective Relays                           | ABB, JYOTI, SIEMENS, ESSUN & RAY, ROLLE , GEC, ALSTOM, L&T, CSEG,<br><br>MAKE OF MAIN PROTECTIVE RELAY SHALL BE RESTRICTED TO AREVA/ABB/ SIEMENS AS PER NIT. |
| 2       | AUXILIARY RELAY                             | BCH,GEC, ALSTOM, L&T, SIEMENS,ABB  |
| 3       | OVER LOAD RELAY/<br>THERMAL OVER LOAD RELAY | L&T, SIEMENS, TELEMECHANIQUE & CONTROLS, ABB, BCH,CGL, SCHNEIDER, SPACEAGE-HYUNDAI   |
| 4       | PROTECTIVE RELAY/ MOTOR PROTECTION RELAY    | ABB, ALSTOM, GEC, EASUN, Siemens, Areva  |
| 5       | TIMER/ AUXILIARY CONTROL RELAY              | ABB, BCH, GEC,L&T, ALSTOM,SIEMENS, TELEMECHANIQUE & CONTROLS.  |
| 6       | INTER POSING RELAY FOR COMMANDS O/P TO MCC  | JYOTI, H&B, GEC, ALSTOM, OEN , OMRON, HONEYWELL<br><br>ENGLISH ELECTRICAL,SIEMENS ,ABB   |
| 7       | MCCB  | GE, HAVELLS, MDS, L&T, SIEMENS, STANDARD, SPACE AGE, HUNDAI, SCHNEIDER, CGL, NGEF, ALSTOM, CONTROL & SWITCHGEAR CO. LTD.                                     |
| 8       | MCB   | CGL, GEC, ALSTOM, HAVELLS, MDS, L&T, SIEMENS,STANDARD, SCHNEIDER, NGEF, ABB  |
| 9       | FUSES & FUSES SWITCH ON                     | GEC, ALSTOM, L&T, NGEF, SIEMENS, COOPER BUSMAN, EE,  |



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|---------|---|---|
|         | / OFF SWICHES /HRC FUSES WITH BASE                  | STANDARD  |
| 10      | SWITCH SOCKET OUTLET INDUSTRIAL                     | BCH, BEST & CROMPTON, CGL, GEC, REY ROLLE, BARN, ANCHOR.  |
| 11      | AMMETER & VOLTMETER                                 | AUTOMATIC ELECTRIC,ABB,IMP, MECO, L&T, RISHAB, SILKANS  |
| 12      | METAL CLADE PLUG & SOCKET(INCLUNIND WELDING SOCKET) | BCH, BEST & CROMPTON, CGL, EE, REY ROLLE, BARN, EASUN   |
| 13      | HT AC MOTORS  | BHEL, CGL, GEC, ALSTOM,KIRLOSKAR ELECTRIC CO; NGEF, SIEMENS, ABB, GE, HITACHI, TOSHIBA, LG,JYOTI LIMITED<br><br>MARATHON ELECTRICAL, ANSALOD (ITALY), MELCO (JAPAN) |
| 14      | LT AC Motors  | ABB, CROMPTON GREAVES, ALSTOM INDUSTRIAL, GEC, KIRLOSKAR ELECTRIC CO;NGEF, JYOTI, SIEMENS, BHARAT BIJLEE LTD; LG , TOSHIBA, ANSALDO, GE, MELCO, MARATHON , BHEL     |
| 15      | LT AC Geared Motors                                 | GEC, ALSTOM, KIRLOSKER, ELECTRIC CO.  |
| 16      | DC Motors   | GE-USA OR EQUIVALENT<br><br>ALSTOM LTD/BHEL/ CROMPTON GREAVES LTD./GE/ KIRLOSKAR ELECTRIC CO. LTD. , SIEMENS / MELCO/ ABB   |
| 17      | Thruster brake                                      | ELECTROMAG DEVICES, STROM KRAFT CONTROLS  |



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| 18      | DC Electro magnetic Brakes                | BCH, ELECTROMAG DEVICES, STROM KRAFT CONTROLS, ELECTRONICS & POWER CONTROL .   |
| 19      | Pull Cord Switch,Belt Sway Switch / Relay | AG MECHANICAL ENTERPRISE, AG SYSTEM CONTROL, DEV ENTERPRISE, PBL.  |
| 20      | CONTROL/ SELECTOR SWITCH                  | BCH, GEC, ALSTOM, JYOTI, KEYCEE, RECOM, RICO, SWITRON, ABB, L&T, SIEMENS, KROUS-NAIMER SALZER                                  |
| 21      | PUSH BUTTONS                              | BCH,GEC, ALSTOM, L&T, TELKNIC, SIEMENS, VAISHNO, RASS CONTROL  |
| 22      | TERMINAL BLOCK                            | CONNECTWELL, ELEMEX, TECHNOPLAST , TOSHA, VINPAR, PHOENIX, WAGO  |
| 23      | CT's & PT's                               | A.E., ABB, ASEA, G&W, GUJARAT PLUGIN (DIGITRONICS), JYOTI, KAPPA, , ECS, SIEMENS,AVK-SEG & CONTROLS, PRECISE,INSUTECH., PRAYOG |
| 24      | LIGHTING TRANSFORMER                      | AMAN, POWER PACK, INDICOIL, PRECISE, VOLTAS, UNIVERSAL MAGNETIC, VOLTAMP, AMES IMPEX, KIRLOSKAR ELECTRIC AE                    |
| 25      | CONTROL TRANSFORMER                       | A.E., AMAN , GUJARAT PLUGIN (DIGITRONICS), GUJ.TRANSFORMER, INDUSTRIAL PRAYOG, NEG, LOGICSTAT ,AVK-SEG & CONTROLS ,PRECISE     |
| 26      | 6.6 KV / 433 V DRY TYPE ST                | CGL,BHEL,VOLTAMP, INTRA-VIDYUT, DU PONT-RELIA. TRAN; AMES-IMPEX, INDCOIL   |



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|         |   | VOLTAS/BHARAT BIJLI / VIJAY ELECTRICAL  |
| 27      | NEUTRAL GROUNDING TRANSFORMER                       | PS ELECTRICALS, PRAYOG, INTRA-VIDYUT, AMEX-IMPEX, DU PONT-RELIA TRAN. VOLTMP. VIJAY ELECTRICALS   |
| 28      | NEUTRAL GROUNDING RESISTOR                          | PEFCO, STROM KRAFT, RESITECH, RS, NARKHADE, POWER CONTROL EQUIPMENT, INDCOIL, BCH, LACHHMAN ELECTRONICS<br><br>RSI SWITCHGEAR, RESITECH |
| 29      | 415 V MCC & PMCC                                    | L&T, SIEMENS, GE POWER, CONTROLS AND SWITCH GEAR, SCHNEIDER, CONTROLS & SCHEMATICS, SPACEAGE SCHNIDER/ AREVA                            |
| 30      | ESP/ AUXILIARY CONTROL PANEL & LT MAIN SWITCH BOARD | LARSON & TOUBRO LTD; CHENNAI, SIEMENS INDIA LTD; CHENNAI, SCHENIDER ELECTRIC-NASIK, CONTROL & SWITCH GEAR CO. LTD; NEW DELHI            |
| 31      | CONTROL PANEL FOR CWP                               | PROCON-INDIA, PANAM CONTROLS-INDIA, PYROTECH-UDAIPUR  |
| 32      | 415 V / 3 PHASE/ AC SQ . INDUCTION MOTOR            | KIRLOSKAR, BBL, SIEMENS, ABB CROMPTON, GE,MARATHON,ALSTOM   |
| 33      | LT AIR C.B.   | ABB, CGL, ALSTOM , CS TERASAKI, L&T, GEC,NGEF, VOLTAS., SIEMENS, SCHNEIDER, SPACEAGE-HYUNDAI  |
| 34      | CONTACTOR   | ABB, BCH, L&T, TELEMECHANIQUE & CONTROLS (I) LTD., SIEMENS, SCHNEIDER, SPACEAGE-HYUNDAI   |



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|---------|---|---|
| 35      | MOTORISED ACTUATORS(ELECTRICAL ACTUATOR) FOR VALVE / GATE/ FLAPS/DAMPERS etc. | AUMA , BEACON , ROTORK, LIMIT TORQUE, TECHNO-MECH, ACTUATORS INDIA, PRECISION, CONTINENTAL PROFILES, HMT  |
| 36      | Actuator ( Electrical & Pneumatic)  | AUMA , BEACON , ROTORK, LIMIT TORQUE, TECHNO-MECH, ACTUATORS INDIA, PRECISION, CONTINENTAL PROFILES, HMT<br><br>SMC PNEUMATICS/BACHMANN/KELTROL CONTROL/INSTRUMENTATION LTD/HEIN-LEHMANN  |
| 37      | HOOTER/ BELLS   | ILK, INSTALARM, PROCON.   |
| 38      | INDICATING METERS   | AUTOMATIC ELECTRONIC LTD; GEC, ALSTOM, L&T, IMP, MECO<br>RISHABH / CONZERV/ENERCON  |
| 39      | LIGHT FITTING LUMINAIRES  | BAJAJ, CROMPTON , PHILIPS, WIPRO, SPACEAGE FOLLOWING PACKAGE SUPPLIER USING ABOVE MAKE IS ACCEPTABLE :- L N T/PHILIPS/SPACEAGE/TECHNO ELECTRICAL/BAJAJ/CGL)Energy efficient type GE /CGL/ L&T/TECHNO ELECTRICAL Flame proof type BALIGA/CEAG/BAJAJ, CGL , PHILIPS |
| 40      | CABLE GLAND   | BRACO, COMET, CONTRACT, HARDWARE INDUSTRIES, ELECT ENG; LAPP  |
| 41      | CABLE TRAYS   | AV ENGINEERS, BARODA GALVANISERS, INDIANA, NIRMAL ENGG; PAREKH ENGINEERS, VATCO, SADHNA, JAMNA METAL  |



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| SR. NO. | DETAILS OF EQUIPMENT/SYSTEM                                       | FINAL APPROVED VENDOR  |
|---------|---|--|
| 42      | LIGHTING PANEL AND PUSH BUTTON STATIONS                           | HENSEL, Siemense, Havell's, Bajaj, Philips, L & T,   |
| 43      | CONTROL PANEL, CONTROL DESK, AUXILIARY PANEL & INDICATING DESKS   | ABB, BEST & CROMPTON , ELEMECH, GEC , ALSTOM , NIRMAL , NGEF, OSAKA , SIEMENS , TLK, EASUN REYROLL, ELPRO, L&T, PYRO TECH , PROCON , RITTAL, BELLS, FOX BORO , ILK, APW, PECON   |
| 44      | MOSAIC GRIDS  | SUB-KLEW – GERMANY, SIEMENS – GERMANY , SYMO - SWITZERLAND/PYROTECH, ICA   |
| 45      | MOSAIC GRID PANELS  | PYROTECH, ICA/<br>SUB-KLEW – GERMANY, SIEMENS – GERMANY , SYMO - SWITZERLAND<br><br>PYROTECH/IL KOTA/CHENNAI CONTROLS<br><br>ADDITIONAL SUB VENDOR<br>CONTROL & SCHMATICS/VIMAC/RITAL  |
| 46      | THYRISTOR PANELS  | ABB, KIRLOSKAR, L&T, OSAKA, SIEMENS  |
| 47      | RELAY PANELS  | ALSTOM, ABB, EASUN REY ROLLE   |
| 48      | 415 V 240V AC 24 V DC LIGHTING DISTRIBUTION BOARD/DCDB 415 V PCCs | USHA ENGINEERS , SHEETAL ENGRS., ELECTRICAL FABRICATION AND ERECTION, BARODA, INDUSTRIAL CONTROLS, PBB, OSAKA, ELEMECH, NIRMAL, TECHNO ELECT., L&T, SIEMENS, ALSTOM, GE POWER, CONTROL & SWITCH GEAR, CONTROLS & SCHEMATICS, HEI, SPACEAGE, VIDYUT CONTROLS, KRYPTON, ADLEC, ADVANCE, RITTAL, JASPER ENGG., HENSEL, HAVELLS , INDO ASIAN, NATIONAL ENGRS., STEMEC , MAKTEL SYSTEM, POPULAR |



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|---------|---------------------------------------|--|
|         |                                       | SWITCHGEAR, SINTEX   |
| 49      | ACDB/DCDB/MLDB                        | L N T, HAVELLS/PYROTECH, MDS/INDU. SWGR./C&S/, SIEMENS/ALSTOM/GE POWER/CONTROLS & SWITCHGEAR   |
| 50      | TERMINAL BOX                          | GEC, ALSTOM, ASEA, CONNECT WELL, ELMEX   |
| 51      | PANEL HEATERS & THERMOSTATE           | VILECO, ANCO, RANUTROL, CSC, ISO TEMP., KC & SONS, TEMPTROL  |
| 52      | KWH METER/Mvar meter/MW/Energy meter  | IMP, GEC, SIMCO, SIEMENS, ENERCON  |
| 53      | MINITURE PB/ ILLUMANATED PB           | H&B, IL, SYLO  |
| 54      | PUSH BUTTONS FOR FIELD MOUNTED PANELS | SIEMENS, L&T, C&S-NEW DELHI.   |
| 55      | SINGLE LAMP FOR FIELD MOUNTED PANELS  | SIEMENS, L&T, GEC, ALSTOM, TECHNIC   |
| 56      | UPS                                   | IL-JAIPUR, HI-REL-GANDHINAGAR, TATA, LIEBERT, DB ELECTRONICS, EMERSON, SOCOMEC, GUTUR<br><br>FUJI / SIEMENS / APCARE<br><br>Merlin Gerin<br>PTE/CHLORIDE-UK/GOUTOR/KELTRON |
| 57      | SMF BATTERY FOR UPS                   | AMAR RAJA, HBL NIFE, EXIDE   |



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|---------|---|--|
| 58      | LT XLPE POWER CABLES AND PVC CONTROL CABLES | HAVELLS, TORRENT, NICCO, FINOLAX, RAVIN, GOVIND , LAPP, INDUSTRIAL CABLES, KRISHNA ELECTRIC, FINE CAB., SPL CABLES, RADIANT, SUYOG, PARAMOUNT, VIKAS CABLES, CORDS, ALPHA, GEMS CAB. , TCL, ROLLEX, KEI, CRYSTAL, POLYCAB, DELTON, RELIANCE ENGINEERS, RPG, ASSOCIATE CABLES, ELKAY TELELINKS, UNIVERSAL, FGI<br><br>CCI/UNIVERSAL |
| 59      | HT POWER CABLES                             | UNIVERSAL, HAVELLS, POLYCAB, TORRENT, NICCO, FINOLAX, INDUSTRIAL CABLE, RPG, FORTGLOSTER<br><br>KEI/INCAB / ASIAN/ CCI /<br><br>SIEMENS,ALSTOM,BHEL,CGL,ABB,MARATHON<br><br>CCI/HGI<br>ADDITIONAL: RADIANT CABLE/ INCAB/INDUSTRIES CABLE/  |
| 60      | FIRE ALARM CABLING                          | FORT GLOSTER , INCAB, IAEL, NICCO  |
| 61      | 220 VOLT DC BATTERY                         | EMCO, EXIDE, SABMIFE, HBL-SABNIFE, FUJI<br><br>Lead Aid -Plante battery- EXCIDE.<br><br>NI-CD BATTERY<br>AMAR RAJA/HBL KNIFE/SAB KNIFE/FUJI/AMCO/SAFT<br><br>SEALED MAINTENANCE FREE BATTERY VRLA BATTERY.- EXCIDE./AMAR RAJA/HBL KNIFE/SAB KNIFE/FUJI/AMCO/SAFT   |
| 62      | 220 VOLT DC BATTERY CHARGER                 | CHHABI, MASS-TECH, AMARA RAJA POWER SYSTEM LTD., STATCON, SABNIFE, CALDYNE, BCH, KAYBEE<br><br>HBL,DUBAS,SABNIFE POWER SYSTM,DB POWER ELECTRONICS<br><br>AUTOMATIC ELECTRIC LTD./ HBL-NIFE/ HIND RECTIFIES/  |



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|---------|-------------------------------|--|
|         |                               | DUBAS ENGG.  |
| 63      | FIRE PROOF PENETRATION SYSTEM | LLOYD INSULATION , MULTKILN FIRE , NAVAIR INTERNATIONAL LTD.   |
| 64      | 1.1 KV NON SEG PHASE BUS DUCT | <p>CONTROLS &amp; SWITCHGEARS, SPACEAGE, ELPRO, STARDRIVE, EMFORM</p> <p>addi.vendor.Isolated Phase Bus-Duct (IPBD) : BHEL,<br/> addi.vendor Segregated Phase Bus-Duct (SPDB) : BHEL,</p> <p>Non-Phase segregated Bus-duct (NPSBD):<br/> Eswaran &amp; Sons/KLK Industries/Best &amp; Crompton/Engineering Construction Cor.<br/> Additional Sub-vendors for NPSBD:<br/> Rajrajan/Globe Electrical/Control &amp; Schematics/Power Gear</p> |
| 65      | ANNUCIATION                   | <p>IL- KOTA, PROCON, RIS TRICON, RONAN. MASSIBUS, PYRO TECH.</p> <p>IIC</p>  |
| 66      | ANTI- SURGE CONTROLLER        | MTL, P&F, PHONEIX  |
| 67      | SURGE ABSORBER                | MTL, WEIDMULLER, P&F   |
| 68      | ERECTION HARDWARE             | MICROPRECISION, WESMEC ENGG., MET PRESS, SMC PNEUMATIC, SAPAG  |
| 69      | AC To DC Convertor            | PHOENIX, SIEMENS, COSEL-GERMANY  |
| 70      | 400 KV SWITCHYARD             | ABB; SIEMENS; AREVA; L&T; BHELFOR GISHITACHI   |



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|         |                             | /TOSHIBA/ABB; SIEMENS; AREVA; FOR AISABB; SIEMENS; AREVA; L&T; BHEL                              |
| 71      | C.B.                        | ABB; SIEMENS; ALSTOM; CGL  |
| 72      | DISCONNECTOR                | ABB; STERLLING; HIVELEN;GR POWER,BIMCO; ELPRO  |
| 73      | SURGE ARRESTERS             | OBLUM; ALSTOM; ELPRO; CGL ,LAMCO   |
| 74      | BUS SUPPORT INSULATORS      | VSI; WSI; IEC; MODERN  |
| 75      | CTs/VTs/CVTs                | ABB; CGL; WSI  |
| 76      | ACSR CONDUCTORS             | APAR; OMERGA; SMITA; HVPL STYERLITE; KEI   |
| 77      | CLAMPS & CONNECTORS         | KLEMMENS; TYCO; FRAMATOME; RASHTRIYA UDYOG   |
| 78      | STRUCTURE                   | UTKAL/RICHARDSON & GUDAS; BARODA STRCUTRUALS; KALPATRU; TECHNO ENGG; M V ENGG; METALLITE/TRIVENI |
| 79      | INSULATION HARDWARE         | RASHTRIYA UDYOG; INTERNATIONAL TRANSMISSION PRODUCTS;MODERN MELLEABLES; TYCO; EMC                |



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| 80      | MARSHALLING KIOSKS/JB   | CONTROLS & SWITCHGEAR; ANDREW YULESPACEAGE SWITCHGEAR; BCH; ENTERPRISING ENGINEERS; MIKA ELECTROCONTROLS;  |
| 81      | SUBSTATION MANAGEMENT SYSTEM / SCADA CONTROL/ RELAY PANELS / RELAYS | ABB ; SIEMENS ; AREVA  |
| 82      | TARIFF METERING   | SIEMENS , ABB , SEMS, L&T  |
| 83      | G.T., S.T. & U.T.   | BHEL, CGL, ABB, ALSTOM, HYUNDAI, TOSHIBA, SIEMENS<br><br>FOR GT----AREVA/CGL/ABB/TELK/BHEL JHANSI<br>FOR ST & UT---- CGL/BHARAT BIJLI/AREVA/VOLTAMP BARODA/BHEL JHANSI   |
| 84      | AUXILIARY TRANSFORMER   | EMCO, ALSTOM, VOLTAMP, BHARAT BIJLEEAPPROVED FOR ONAN--CGL/VOLTAMP TRANS/AREVA/EMCO/BBL/VIJAY ELECT/BHEL/ALSTOM/SIEMENS FOR DRY TYPE--- CGL/VOLTAMP TRANS/KIRLOSKAR/VIJAY ELECTRICAL/BHEL/AMEX IMPEX/UNIVERSAL/HYUNDAI |
| 85      | MV SWITCHGEAR   | BHEL, ABB, SIEMENS, ALSTOM, TOSHIBA, SCHNEIDER, JYOTI  |
| 86      | LV SWITCHGEAR   | L&T, SIEMENS, GE, CONTROLS & SWITCHGEAR, EUFORM, SPACEAGE  |



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|         |                             | ABB/ALSTOM/SCHNEIDER ELECTRICAL   |
| 87      | BUS DUCT                    | <p>BHEL, CONTROLS &amp; SWITCHGEAR; EUFORM, GE, SPACEAGE</p> <p>IPBD<br/>           POWER GEAR /BHEL/CONTROL &amp; SWGR</p> <p>NSPBD -LV<br/>           C &amp; S /STAR DRIVE/POWER GEAR/SPACE AGE/ENPRO/ELPRO/REEP/UNILEC/CONTROL &amp; SCHEMATIC/RAJ RAJAN/BEST &amp; CROMPTON</p> <p>MV BUS DUCT (SPBD)<br/>           C &amp; S /STAR DRIVE/POWER GEAR/SPACE AGE/BHEL/ALSTOM</p> <p>Additional Sub-vendors for SPBD:<br/>           Globe Electricals</p> <p>Non-Phase segregated Bus-duct (NPSBD):<br/>           Eswaran &amp; Sons/KLK Industries/Best &amp; Crompton/Engineering Construction Cor.</p> <p>Additional Sub-vendors for NPSBD:<br/>           Elpro/Rajrajan/Globe Electrical/Control &amp; Schematics</p> <p>STAR DRIVE,POWER GEAR,GLOBE ELECTRICAL,ESWARN &amp; SONS,KLK INDUSTRIES,BEST &amp; CROMTON,ENGG. CONSTRUCTION &amp; CORPORATION,RAJRAJAN</p> |
| 88      | DG SET                      | <p>MAN B &amp; W, MODI-MIRLEES, CATERPILLAR, WARTSILA</p> <p>POWERICA,JACKSON,SUDHIR<br/>           GUNSET,SUPERNOVA,CUMMILS<br/>           ADDITIONAL:-CATERPILLER/CUMMINS/WARTSILIA/MAN B &amp;W</p> <p>POWERICA/ SUDHIR/GMMCO LIMITED/ KIRLOSKAR/<br/>           CUMMINS/VOLVO/ STEMFORD/ JACKSON/</p>   |
| 89      | ILLUMINATION FITTINGS       | BAJAJ, CGL, PHILIPS, SPACEAGE, BALIJA (FLAME PROOF)   |



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|         |  | FOLLOWING PACKAGE SUPPLIER USING ABOVE MAKE IS ACCEPTABLE :- L N T/PHILIPS/SPACEAGE/TECHNO ELECTRICAL/BAJAJ/CGL)<br><br>Energy efficient type GE /CGL/ L&T/TECHNO ELECTRICAL<br>Flame proof type<br>BALIGA/CEAG/BAJAJ, CGL , PHILIPS) |
| 90      | PUBLIC ADDRESS SYSTEM                      | PHILIPS , INDUSTRONIC , GAITRONICS<br><br>BOSCH/BNA/ECIL<br><br>ADDITIONAL SUB VENDOR.. ANDREW YULE,/MOTWANE  |
| 91      | EPABX                                      | PHILIPS, SIEMENS, BPL, TATA ELECOM, ERICSSON  |
| 92      | GENERATOR PROTECTION/<br>PROTECTION PANELS | ALSTOM, ABB, SIEMENS<br><br>AREVA   |
| 93      | GENERATOR CIRCUIT<br>BREAKER               | ALSTOM, ABB, MISTUBISHI   |

**Note: Make of any other equipments / item / components not specified in the above list shall be subject to the approval of BHEL/Customer during detailed engineering stage without any price and delivery implication to BHEL. For Additional sub vendor bidder shall submit the credentials of these sub vendors in the attached format Annexure –A.**



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**APPROVED SUB VENDOR LIST FOR C&I ITEMS**

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|--------------------------------------|-----------------------------|---|
| <b>CONTROL &amp; INSTRUMENTATION</b> |                             |   |
| 1                                    | Limit Switches              | BCH, ELECTROMAG DEVICES, STROM KRAFT CONTROLS , ELECTRONICS & POWER CONTROL , SRERING CONTROLS , SIEMENS, JAI BALAJI, ENGINEER AGENCIES, BHARATHIYA CULTER & HAMMER,KAYCEE,HONEYWELL ,RL TECHNOLOGIES / CHENNAI KA SCHMERSAL, GERMANY, JOHAN VOLLENBROICH, GERMANY, IFM ELECTRONIC, GERMANY , JAYASHREE ELECTRON PVT. LTD, PEPPERL+FUCHS(INDIA) PVT LTD,ELECTRO MECHANICAL INDIA, KOLKATA , ELECTRICAL EQUPT. CORPN., NEW DELHI, AG Systems, (AG Electronics )MUMBAI,Beta Systems engineering, RL TECHNOLOGIES / CHENNAI. KA SCHMERSAL, GERMANY, JOHAN VOLLENBROICH, GERMANY, IFM ELECTRONIC, GERMANY , JAYASHREE ELECTRON PVT. LTD, PEPPERL+FUCHS(INDIA) PVT LTD,ELECTRO MECHANICAL INDIA, KOLKATA , ELECTRICAL EQUPT. CORPN., NEW DELHI, AG Systems, (AG Electronics )MUMBAI,Beta Systems engineering |
| 2                                    | Pressure Switches           | SWITZER , INDFOSS , DELTA , UK, DRESSER , USA., VASUTECH, DANFOSS ,PYRO ELECTRIC, CHEMTROL , ASHCROFT, DWYER, SOR,E&H/,,GIC(Mumbai), Precision (Ahmedabad), Trafag(Ranipet), GENERAL INSTRUMENTS CONSORTIUM ,GOA GIC(Mumbai), Precision (Ahmedabad), Trafag(Ranipet)  |
| 3                                    | Temperature Switches        | SWITZER, INDFOSS, DELTA, UK, DRESSER, USA.,DANFOSS,GIC (Mumbai)GIC(Mumbai), Precision (Ahmedabad), Trafag(Ranipet)  |
| 4                                    | Level Switches              | LEVCON , MEGNETROL, V. AUTOMAT , E&H, MASONELIN, DANFOSS , SBEM(PUNE) , INDFOSS , SWITZER, PYRO ELECTRIC, CHEMTROL , ASHCROFT,DE LTA CONTROLS,DELTA UK/ DRESSER USA/ ,,DK Inst(Kolkata), Sigma Inst(Mumbai), BHEL(Trichy), Levelstate(UK), Solarton/ Mobrey(UK)DK Inst(Kolkata), Sigma Inst(Mumbai), BHEL(Trichy), Levelstate(UK), Solarton/ Mobrey(UK)   |
| 5                                    | Level Indicator             | ENDRESS AND HAUSER- GERMANY, E.IP BULK CONTROLS, KISTLEMORSE, TROLEX,,EIP ENVIROLEVEL CONTROLS LTD DELHI, SB ELECTRO MECHNICAL PVT. LTD PUNE, NIVO CONTROLS INDORE EIP ENVIROLEVEL CONTROLS LTD DELHI, SB ELECTRO MECHNICAL PVT. LTD PUNE, NIVO CONTROLS INDORE.  |
| 6                                    | Flow Switches               | SWITZER , INDFOSS , V. AUTOMAT,GENERAL INSTRUMENT /DELTA UK/ DRESSER USA/ E&H/,,Krohne Marshall (Pune)-CHEMTROLS INDUSTRIES LTD.,MUMBAI / Krohne Marshall (Pune)  |
| 7                                    | Transducer                  | AE, SOUTHREN , MECO, SIEMENS, ABB,Adept(Pune), Elster(Mumbai), Lectrotek (Pune), Masibus(Gandhinagar), MECO(Mumbai), Pyrotech(Udaipur), Adept(Pune), Elster(Mumbai), Lectrotek (Pune), Masibus(Gandhinagar), MECO(Mumbai), Pyrotech(Udaipur),   |
| 8                                    | Electronic Transmitter      | H&B, ROSEMOUNT, IL, FUJI MAKE,ABB, Emerson, Honeywell, YokogawaABB, Emerson.  |



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| SR. NO. | DETAILS OF EQUIPMENT/SYSTEM                               | FINAL APPROVED VENDOR   |
|---------|---|---|
| 9       | Level Transmitters (Displacer Type)                       | FISHER, TOKYO KESIO-JAPAN, MAGNETROL, E&H, MASONELIN,,Chemtrols(Mumbai), ECKARDT(Germany), MIL Controls(Krerala)Chemtrols(Mumbai), ECKARDT(Germany), MIL Controls(Krerala)  |
| 10      | Receiver Recorder   | IL, FUJI MAKE , LAXSON-CHINO MAKE,CHISSEL, EUROTHERM TOSHNIVAL ,SIKURA, ABB/YOKOGAWA,HONEYWELL / YOKOGAWA/  |
| 11      | Auto Manual Station 24 x 48 MM , Indicator Size 48x48 MM. | MAIN C&I VENDOR, BELLS , FOX BORO , SIEMENS , ABB , ILK,,Proplan(Germany), SYMO(Switzerland), TEW(Germany), GANZ(Budapest), Gossen (Germany), Pyrotech (Udaipur), Weigel(Germany)Proplan(Germany), SYMO(Switzerland), TEW(Germany), GANZ(Budapest), Gossen (Germany), Pyrotech (Udaipur), Weigel(Germany)   |
| 12      | Microprocessor Based Single Loop Controller               | IL, BELLS, FOXBORO, SIEMENS, ABB  |
| 13      | Control Station (Desk Mounted) 24x48 MM.                  | MAIN C&I VENDOR, BELLS , FOX BORO , SIEMENS , ABB , ILK ,Pyrotech (Udaipur)   |
| 14      | Receiver Indicator BARGRAPH                               | TELETERM , CG , H&B, LAXSON CHINO,MASIBUS / HONEYWELL/ ABB / YOKOGAWA/ SIEMENS /Gossen/ Camille bauer/ Metrawatt (Germany), Lektrotek (Pune), Pyrotech.   |
| 15      | Pressure Gauges   | BELLS CONTROLS , H.GURU, GENERAL INSTRUMENTS GIC , PYRO ELECTRIC, AN INSTRUMENTS, WIKA, INDFOSS, GLUCK(INDIA), WAAREE, MANOMETER(I), BUDENBERG, KONICS/KOREA, ASCHOFT,,Forbes Marshall (Hyd), GIC (Mumbai), ODIN (Ahmedabad), KROHNE MARSHALL PVT LTD., PUNE / Hirlekar Precision Engg. Pvt. Ltd.-FORBES MARSHALL PVT. LTD., PUNEFORbes Marshall (Hyd), GIC (Mumbai), ODIN (Ahmedabad), KROHNE MARSHALL PVT LTD., PUNE / Hirlekar Precision Engg. Pvt. Ltd. |
| 16      | Draft Gauges  | BELLS CONTROLS , SWITZER , H.GURU,GENERAL INSTRUMENTS,GIC,DRESSER, ,AN INSTRU,MANOMETER,WIKA,GOA THERMOSTATIC,MANOMETER,WIKA,GOA THERMOSTATIC   |
| 17      | Level Gauges  | LEVCON, TECHNOMATIC , TOSHNIWAL, MAGNETROL,KROHNE, E&H, V AUTOMAT,CHEMTROLS,,DK Inst(Kolkata), SBEM(Pune), Sigma Inst (mumbai)  |
| 18      | Differential Pressure Indicator.                          | SWITZER, BELLS CONTROLS , GENERAL INSTRUMENTS, WIKA, AN INSTRUMENTS, H.GURU   |
| 19      | Temperature Gauges.                                       | BELLS CONTROLS, H.GURU, GENERAL INSTRUMENTS GIC, PYRO ELECTRIC, AN INSTRUMENTS, WIKA-GERMANY, DRESSER, INDFOSS, WAAREE, ASCHOFT,Forbes Marshall (Hyd), Goa Thermostatic Inst( Goa) , Wika(India)  |
| 20      | Thermo couples/RTD/ Temperature Elements                  | GENERAL INSTRUMENTS- MUMBAI / GOA , PYROTECH, DETRIVE, PYRO INST; PYRO ELECTRIC, TEMPSEN, PANAM ENGINEERS, HONEYWELL, YOKOGAWA, ROSSEL,,Industrial Insts (Kolkata),DETRIV INSTRU.,TECHNO INSTRU.,Toshnival / NAGMAN SENSORS, CHENNAI / ALTOP INDUSTRIES, VADODARA / BELLS CONTROLS LIMITED / WAREE INSTRUMENTS LIMITED,/ Radix electro system P.Ltd   |
| 21      | Temperature Convertor Transmitter                         | TELETERM , TOSHNIWAL , ROSEMOUNT , BLUE STAR , YOKAGAVA , RIS,ABB/ EMERSON/   |



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| SR. NO. | DETAILS OF EQUIPMENT/SYSTEM  | FINAL APPROVED VENDOR   |
|---------|--|---|
| 22      | Mass Flow Meter  | MICROMOTION , KROHNE MARSHALL, ROSEMOUNT, ULTRA FILTER , ABB, YBL, DIELEN, E&H  |
| 23      | Rotameter  | INSTRUMENT ENGR. HYD. TRANSDUCER AND CONTROL , HYD. , V. AUTOMAT ,Eureka (Pune), Fluidyne Ins(Mumbai), Placka (Chennai),CHEMTROLS SAMIL (INDIA) PVT.LTD.  |
| 24      | PH / Conductivity meter /ORP meter   | ABB, DKK, POLYMETRON, , HACH , BROWN & LEUBBE   |
| 25      | Dew Point Apparatus  | ADP MANUFACTURER, WALKER (UK), ULTRAFILTER (GERMANY)  |
| 26      | Air Filter Regulator   | SHAVO , PLACKA, MASONEILAN,,VEWAN,DIVYA CONTROL, NUCON/ VELJAN HYDRAIR, HYDERABAD/ SAGA INDUSTRIES / KERALA   |
| 27      | 24 Volt DC Supply System   | AFCOSET , CHHABI , STENDARD, Amar Raja(Tirupati), Caldyne (Kolkata), HBL Power (Hyd), Mastech (Mumbai), DB Power (Pune), Chloride (UK), ELTEK-SGS (Pune)  |
| 28      | Vibration Measuring System / Vibration Monitoring System                                   | SHINKAVA, BENTLY NEVADA, IRD, VIBROMETER,,Rockwell (USA/ India), SKF (USA/ India), Rockwell (USA/ India), SKF (USA/ India)  |
| 29      | Cables: Inst. &Compensating Cables   | NICCO, DELTON, TORRENT, RELIANCE, FINOLAX ,UNIVERSAL, INCAB, FORT GLOSTER, CCI ,TOSHNIWAL, URJA, VIKAS, NICCO, ASSOCIATED,CORDS, LAPP, BELDEN-USA,KEI/BELDON,POLYCAB/ Advance Cables (Bangalore), Goyolene (Mumbai), Habia(Sweden), Heavel(Bangalore), Kerpen (Germany), Paramount (Alwar), Thermo cables (Hyd), Thermo Electric ( Netherland), GEMSCAB,KEI,KEC,ELKAY TELELINK. |
| 30      | Annubar  | DIETRICH (FISHER ROSEMOUNT), MICROPRECISION, TECHNOMATIC  |
| 31      | SOE  | MAIN C&I VENDOR. BELLS , FOX BORO , SIEMENS , ABB , ILK   |
| 32      | Temperature Scanners.  | PROCON, DIGICONT, MASSIBUS,   |
| 33      | Ultrasonic Level Transmitter   | ENDRESS & HAUSER , V.AUTOMAT , ROSEMOUNT, NIVEL CO. , CHEMTROL,SAPCON (VEGA),,Krhone (France), Simens Miltronics (Canada),  |
| 34      | Remote Electronic Drum Level Indicator   | HYDRASET (SOLATRON),LEVELSTATE UK, Yarway   |
| 35      | Mass flow meter (Coriolis Principle)   | EMERSON, E&H, YOKOGAWA, ABB,MICROMOTION/,ROSEMOUNT.   |
| 36      | Electronic Indicators / Controllers / Microprocessor Based Recorders / Receiver Indicator. | HONEYWELL, ABB, YOKOGAWA, LAXSONS – CHINO, GOSSEN,BELLS ,FUJI,EUROTHERM,SIEMENS,,Masibus (Gandhinagar), Pyrotech, Teletherm (Chennai)   |
| 37      | Smart Transmitter (P,L,F, DP)  | FISHER ROSEMOUNT (3051 MODEL), YOKOGAWA -JAPAN , FUJI , ABB(2600 MODEL)   |
| 38      | I/P Converters   | MOORE CONTROLS, EMERSON, WATSON SMITH(MTL), H&B(ABB), SMC PNEUMATIC,,Fairchild (USA), MTL (India)   |



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|---------|--|---|
| 39      | PLC  | ROCKWELL, GEFANUC, ABB, SIEMENS, HONEYWELL, GROUP SCHNEIDER, ALLEN BRADLEY, YOKOGAWA  |
| 40      | DCS  | YOKOGAWA, ABB, SIEMENS, HONEYWELL, OVATION-INVENSYS INDIA PVT LTD ,CHENNAI /L&T -GE /BHEL   |
| 41      | SWAS and Analysers                           | POLYMETRON /EW LOWE, UK MAKE ,A B B KENT, U. K. MAKE ,D K K JAPAN MAKE, FORBES MARSHAL,,ABB (India), Emerson Process(India), IL Kota, Yokogawa (India), Honeywell (India)-STEM EQUIPMENTS [SEPL,INDIA]  |
| 42      | Flue Gas Analysers                           | LAND COMBUSTION, CODEL, AMETEK, DURAG,,ABB, Emerson Process, Fuji, Maihak AG, Siemens Germany, Yokogawa, Procal (UK), SICK Gmbh, Opsi (Sweden), Teledyne (USA)-CHEMTROLS INDUSTRIES LTD.,MUMBAI   |
| 43      | Pressure Reducing & Desuperheating Stations  | SPIRAX MARSHALL, SULZER, KEYSTONE, YARWAY, FISHER SANMAR, ILP   |
| 44      | Safety Barrier                               | MTL P & F   |
| 45      | Inst. Calibration Equipment                  | YOKOGAWA, BEAMEX, DRUCK, DOT. SCANDURA, TINSLEY, EUROTRON, BHEL-EDN approved vendors.   |
| 46      | IMPULSE AND SAMPLE PIPING TUBES AND FITTINGS | TPS TECHNITUBE, SUMITAUO-JAPAN TECHNOMATIC – ITALY, PARKER, SWAGELOK,,Pipes : BHEL(T), Choksi Tube (India), Heavy Metal tubes(Ahmedabad), India Seamless(India), Jindal saw pipes(India), Mahalakshmi seamless (Maharashtra), Mannesmann ( Germany), Ratnamani metals (Ahmedabad), Suraj stainless (Ahmedabad), Trouvay Cauvin (Dubai) Fittings : Astec valves(Thane), Aura (N Delhi), Excel Hydro (Pune), Fluid controls (Mumbai), HP Valves & fittings( Chennai), Metpress Engg (Kolkata), Panam Engrs (Mumbai), Precision Engg. (Mumbai) MULTIMETAL, VALDEX, HP VALVES, MET PRESS-GENERAL INSTRUMENTS CONSORTIUM ,GOA. |
| 47      | Scanner                                      | PROCON, MASSIBUS, PECON   |
| 48      | Master Salve Clock                           | SERTEL, HOPF GERMANY, KELTRON, ABB/ HONEYWELL, L&T – GE ENERGY/ SIEMENS/ Hathway (UK), Masibus (Gandhinagar), Moser Baer(Switzerland), Sands (Chennai), Advanced Micronics ( Bangalore)   |
| 49      | HART Management System                       | MTL, P & F, EMERSON PROCESS, USA / DAMAN  |
| 50      | LVS  | BARCO, CLARIFY, SYNELEC, Christie ( USA/ Bangalore), Delta (Thailand/Gurgaon), Planer (USA)   |
| 51      | LIE / LIR                                    | IL KOTA, PYROTECH, RITTAL, Chemin (pondicherry), ECIL(Hyd), Forbes Marshall (Pune), Prammen Industries, SAJAS, PRAMMEN, CHEMIN SYSPRO   |
| 52      | O2 CO SPM Analyser                           | CODEL INSTRUMENTAL LTD., UK/SICK, GMBH, GERMANY/LAND INSTRUMENTS INTERNATIONAL ,UK/EMERSON PROCESS MANAGEMENT/ CHEMTROLS/ YOKOGAWA/ FORBES MARSHALL/ AMETEKAIL Siemens Land Combustion / Marvelco / ABB Ltd/Fuji / AIL, Durag Gmbh, Enotech Gmbh, Teledyne (USA).   |
| 53      | CCTV   | BOSCH, GERMANY/HONEYWELL/GODREJ,, PELCO, DIMOND, TLT, MIRCON TEK, TIPL-S V NETWORK TECHNOLOGIES, HYDERABAD /L&T PERITO.   |



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| SR. NO. | DETAILS OF EQUIPMENT/SYSTEM                       | FINAL APPROVED VENDOR   |
|---------|---|---|
| 54      | Position Transmitter                              | ABB-GERMANY/ HONEYWELL-UK/USA / CAMILLE BAUER, Switzerland,,RL TECHNOLOGIES / CHENNAI, BAUER/SWITZERLAND.   |
| 55      | Valve manifolds                                   | ARJUN INC, NEW DELHI /BALDOTA VALVEAND FITTING CO PVT LT,MUMBAI /EXCEL HYDRO PNEUMATICS PVT LD.,MUMBAI /METPRESS ENGINEERING WORKS ,KOLKATA /PRECISION ENGG. INDUSTRIES , MUMBAI /FLOWTECH KOLKATA /HP VALVES & FITTINGS, CHENNAI /ASTEC VALVES & FITTINGS PVT. LTD., THENE /HYDAIRENGG. WORKS, LONAVAL ,,Aura ( N Delhi) |
| 56      | HART Communicator                                 | EMERSON PROCESS(FORMERLY FISHER ROSEMOUNT),USA/DAMAN / YOKOGAWA, JAPAN(YOKOGAWA INDIA LTD, BANGALORE) /MERIAM, USA / CHEMTROLS, MUMBAI /ABB, GERMANY / INDIA /FUJI ,JAPAN /HONEYWELL USA /PUNE  |
| 57      | Zero speed/ Proximity switch                      | TIFENBACH, GMBH, GERMANY/AG SYSTEMS, (AG ELECTRONICS )MUMBAI / PEPPERL+FUCHS(INDIA) PVT LTD   |
| 58      | Flow Integraters                                  | ABB / EMERSON / ENDRESS HAUSER / Gossen / Camille bauer/ Metrawatt, Masibus (Gandhinagar), MCIH(Chennai), Ronan Engg (USA), Yokogawa  |
| 59      | PCS   | HP / IBM/ DELL/ACER ,, IBM-Lenovo   |
| 60      | TFT Monitor                                       | HP / IBM/ DELL,NEC, Samsung, IBM-Lenovo,DIMOND,TLT,MIRCON TEK,TIPL  |
| 61      | Dot matrix Printer                                | EPSON ,WIPRO,HP   |
| 62      | Printers (Laser/Inkjet)                           | HP,CANON,WIPRO,SAMSUN   |
| 63      | ELECTRONIC WEIGHBRIDGE                            | AVERY   |
| 64      | PLC CUM ENGINEERING STATION                       | PLC CUM ENGINEERING STATION SHALL BE SUPPLIED WITH RELAVENT MAKE PLC  |
| 65      | SILICA ANALYSER                                   | YOKOGAWA/ ABB / AMETEK/ FORBES MARSHAL/ EMERSON   |
| 66      | AMBIENT AIR AND WEATHER MONITORING SYSTEM         | THERMOFISHER,ENVIROTECH ,CHEMTROLS  |
| 67      | BOILER PROTECTION SYSTEM/BURNER MANAGEMENT SYSTEM | .-----  |
| 68      | HEA IGNITORS                                      | CBL,HINDUSTAN THERMOMETER,DURAG INDIA   |
| 69      | FLAME MONITORING CAMERA                           | DIMOND,TLT,MIRCON TEK,TIPL  |
| 70      | FLAME SCANNERS                                    | BHEL-TRY  |

**Note: Make of any other equipments / item / components not specified in the above list shall be subject to the approval of BHEL/Customer during detailed engineering stage without any price and delivery implication to BHEL. For Additional sub vendor bidder shall submit the credentials of these sub vendors in the attached format Annexure –A.**



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**ANNEXURE -A**

**FORMAT FOR SUB VENDOR APPROVAL.**

1. Company profile.
2. List of orders executed/on hand for power sectors/Govt. organizations for the items asked for vendor approval.
3. Performance certificates for satisfactory working of the system/equipments.
4. Copies of major supply order.

| <b>Sr. No.</b> | <b>Sr. No. As per NIT list of GSECL</b> | <b>Name of additional Vendor required for approval from the list submitted by you till date.</b> | <b>Systems/ Equipments</b> | <b>Remark</b> |
|----------------|---|--|----------------------------|---------------|
|                |   |  |                            |               |



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## **ANNEXURE-II**

### **MANDATORY SPARE LIST**



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| SL. No.    | Equipment / Package name  | Qty.   | Remarks |
|------------|---|--------|---------|
| <b>1.0</b> | <b>Spares for Horizontal Centrifugal Pumps</b>                          |        |         |
| 1.1        | Shaft   | 1 No.  |         |
| 1.2        | Shaft Sleeve  | 2 Nos. |         |
| 1.3        | Impeller  | 1 No.  |         |
| 1.4        | Impeller locking nut and bolt   | 4 Nos. |         |
| 1.5        | Impeller wear ring  | 4 Nos. |         |
| 1.6        | Casing wear ring  | 4 Nos. |         |
| 1.7        | Oil Seal  | 4 Nos. |         |
| 1.8        | Oil Deflector   | 3 Nos. |         |
| 1.9        | Oil Ring  | 3 Nos. |         |
| 1.10       | Gland Packing   | 4      |         |
| 1.11       | Lantern Ring  | 3 Nos. |         |
| 1.12       | Mech Seal Assembly  | 1 No.  |         |
| 1.13       | Stationary/Carbon Packing and O Ring for Mechanical Seal                | 3 Sets |         |
| 1.14       | Oil Level Gauge   | 3 Nos. |         |
| 1.15       | Coupling  | 2 Nos. |         |
| 1.16       | Rubber Bush for Coupling  | 2 Nos. |         |
| 1.17       | O Rings   | 2 Sets |         |
| 1.18       | Suction Strainers Element   | 3 Nos. |         |
| 1.19       | Bearing for Pump Motor  | 2 Sets |         |
| <b>2.0</b> | <b>Spares for Vertical Type Centrifugal Pumps (at Neutralising Pit)</b> |        |         |
| 2.1        | Complete Bowl assembly  | 1 Set  |         |
| 2.2        | Impeller (s)  | 1 Set  |         |
| 2.3        | Shafts  | 1 Set  |         |
| 2.4        | Casing wearing (s)  | 1 Set  |         |
| 2.5        | Impeller wear ring (s)  | 1 Set  |         |
| 2.6        | Shaft Sleeves   | 2 Sets |         |
| 2.7        | Shaft Couplings   | 1 Set  |         |
| 2.8        | Shaft nuts & keys   | 1 Set  |         |
| 2.9        | Lantern rings   | 1 Set  |         |
| 2.10       | Bell mouth liner  | 1 Set  |         |
| 2.11       | Bearings  | 1 Set  |         |
| 2.12       | Pump motor coupling   | 1 Set  |         |
| <b>3.0</b> | <b>Spares for Agitators</b>   |        |         |
| 3.1        | Gear Box Unit Complete  | 1 No.  |         |
| 3.2        | Bearing for Gear Box Unit   | 1 Set  |         |
| 3.3        | Coupling complete (Motor/Gear box and gear box/agitator)                | 1 Set  |         |
| 3.4        | Coupling Bolts  | 1 Set  |         |
| 3.5        | Coupling shim pack (if applicable)                                      | 4 Sets |         |
| 3.6        | Oil seals   | 4 Sets |         |



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| SL. No.    | Equipment / Package name                            | Qty.   | Remarks |
|------------|---|--|---------|
| <b>4.0</b> | <b>Spares for Valves</b>                            |  |         |
| 4.1        | i) Manual Diaphragm valves                          | 10% of total quantity used for each type and size with minimum no. two (2) for each type and size. |         |
|            | ii) Auto Diaphragm valves                           | 10% of total quantity used for each type and size with minimum no. two (2) for each type and size. |         |
|            | iii) Spare Diaphragm for above                      | 10% of total quantity used for each type and size with minimum no. two (2) for each type and size. |         |
|            | iv) Diaphragm                                       | 10% of total quantity used for each type and size with minimum no. one (1) for each type and size. |         |
| 4.2        | i) Non return valves (NRV)                          | 2 nos. of each size & type   |         |
|            | ii) Flaps for above NRV                             | 2 nos. of each size  |         |
| 4.3        | Gate/Globe/Ballvalves/plug valve/needle valve       |  |         |
|            | i) Upto 4"  | 10% of total quantity used for each type and size with minimum no. two (2) for each type and size. |         |
|            | ii) Above 4"  | 1 no. each type and size.  |         |
| 4.4        | Butterfly valve                                     |  |         |
|            | i) Upto 4"  | 10% of total quantity used for each type and size with minimum no. two (2) for each type and size. |         |
|            | ii) Above 4"  | 1 no. each type and size   |         |
| <b>5.0</b> | <b>Spares for Filter Media/ ION Exchange Resins</b> |  |         |
| 5.1        | Media for Dual Media Pressure Filters               | 10% of total quantity  |         |
| 5.2        | Media for Activated Carbon Filters                  | 10% of total quantity  |         |
| 5.3        | Resins for each type of exchangers                  | 10% of total quantity  |         |
| 5.4        | Packings for Degasser Towers                        | 10% of total quantity  |         |
| 5.5        | Ejectors  | Two (2) nos. of each type including chlorination application.                                      |         |
| <b>6.0</b> | <b>Spares for Air Blowers</b>                       |  |         |
| 6.1        | Impeller with shaft                                 | 1 Set  |         |
| 6.2        | Bearings  | 1 Set  |         |
| 6.3        | Oil seals   | 5 Sets   |         |
| 6.4        | Filter  | 1 Set  |         |
| <b>7.0</b> | <b>Pneumatic Control Valve</b>                      |  |         |
| 7.1        | Pneumatic Diaphragm for Diaphragm actuated valve    | 2 Nos. for each type of Actuator   |         |
| 7.2        | Gland Packing                                       | 1 set for each type of Control Valve   |         |
| 7.3        | Plug, Seat, Cage, Stem etc.                         | 1 set for each type of Control Valve   |         |



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| SL. No.    | Equipment / Package name                                       | Qty.  | Remarks        |
|------------|--|---|----------------|
| 7.4        | Retainer Ring, Seal Ring etc.                                  | 1 set for each type of Control Valve  |                |
| 7.5        | Gasket   | 2 Sets. for each type of Control Valve  |                |
| 7.6        | Position Transmitter complete set                              | 10% of total quantity used in the system for each type and model.                                 |                |
| 7.7        | Control Valve E/P Positioner complete Set                      | 10% of total quantity used in the system for each type and model.                                 |                |
| 7.8        | Complete Set of Solenoid Valve for Pneumatic type On/Off Valve | 2 Nos. for each type & ratings  |                |
| 7.9        | Solenoid Coil for Pneumatic type On/Off Valve                  | 5 Nos. for each type & ratings  |                |
| 7.10       | Position Limit Switch for Pneumatic type On/Off Valve          | 10 Nos. for each type & ratings   |                |
| <b>8.0</b> | <b>Electrical Items</b>  |   |                |
| <b>8.1</b> | <b>415 Volt Motor (above 30KW Rating upto 160KW)</b>           |   |                |
|            | • End Shield Cover Driving & Non-Driving End                   | 1Set for each type and rating of Motor  |                |
|            | • Driving End & Non-Driving End Bearing                        | 1Set for each type and rating of Motor  |                |
|            | • Cooling Fan  | 1No. for each type and rating of Motor  |                |
|            | • Motor Space Heater   | 1No. for each type and rating of Motor  |                |
|            | • Motor Terminal Block   | 1No. for each type and rating of Motor  |                |
|            | • Complete Set of Coupling                                     | 1Set for each Application   |                |
| <b>8.2</b> | <b>415 Volt Motor (Upto 30KW Rating)</b>                       |   |                |
|            | • Driving End & Non-Driving End Bearing                        | 3Set for each type and rating of Motor  |                |
|            | • Cooling Fan  | 2No. for each type and rating of Motor  |                |
|            | • Motor Terminal Block   | 5No. for each type and rating of Motor  |                |
|            | • Complete Set of Coupling                                     | 1Set for each Application   |                |
| <b>9.0</b> | <b>C&amp;I Items</b>   |   |                |
| <b>9.1</b> | <b>UPS (For BOP systems)</b>                                   |   |                |
| 9.1.1      | Fuse   | 3 (Three) times of total quantity of each type of fuses used in the system (for all BOP systems). |                |
| 9.1.2      | SCR  | 10% of total quantity of each type used in the system or minimum 2(two) nos. whichever is more.   | Not applicable |
| 9.1.3      | Diode  | 10% of total quantity of each type used in the system or minimum 2(two) nos. whichever is more.   |                |
| 9.1.4      | IGBT   | 2 (two) nos.  |                |
| 9.1.5      | <b>Electronic Module/ PCB</b>                                  |   |                |
| 9.1.5.1    | Static Switch  | 1 (one) no. each type of Electronic Card/ PCB/ modules used in the system                         |                |
| 9.1.5.2    | Inverter   | 1 (one) no. each type of Electronic Card/ PCB/ modules used in the system                         |                |
| 9.1.5.3    | Static voltage Regulator                                       | 1 (one) no. each type of Electronic Card/ PCB/ modules used in the system                         |                |
| 9.1.5.4    | Charger  | 1 (one) no. each type of Electronic Card/ PCB/ modules used in the system                         |                |
| 9.1.5.5    | UPS of 2 KVA rating or below.                                  | One Complete set.   | Not applicable |
| 9.1.5.6    | Selector Switch  | 1 (one) no. each type   |                |
| 9.1.5.7    | Digital Voltage/ Current Indicator (LCD type)                  | 1 (one) no. each type   |                |
| 9.1.5.8    | Indication Lamp- Complete assembly (Red/ Green colour)         | 1 (one) no. each type   |                |



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| SL. No.      | Equipment / Package name  | Qty.                                   | Remarks        |
|--------------|---|--|----------------|
| 9.1.5.9      | Cooling Fan - 240 VAC supply  | 1 (one) no. each type                  |                |
| <b>9.1.6</b> | <b>UPS Battery</b>  |  |                |
| 9.1.6.1      | Battery Cell (Uncharged, Dry)   | 10% of total quantity of each BOP UPS. |                |
| 9.1.6.2      | Inter connecting cell strips  | 10 nos.                                |                |
| 9.1.6.3      | Rubber gloves   | 1 pair                                 |                |
| 9.1.6.4      | Voltmeter for measuring cell voltage (Center zero type)   | 1 no.                                  |                |
| 9.1.6.5      | Apron & Goggles   | 1 set                                  |                |
| 9.1.6.6      | Cell lifting puller   | 1 no.                                  |                |
| 9.1.6.7      | Insulated socket spanner with handle  | 1 no.                                  |                |
| 9.1.6.8      | Terminal screw with bellaville washer   | 10% of total quantity used             |                |
| 9.1.6.9      | Thermometer   | 1 no.                                  |                |
| <b>9.2</b>   | <b>Field Instruments (Transmitters/temperature elements (TC / RTD) / Gauges / Switches etc. along with relevant accessories)</b>  |  |                |
| <b>9.2.1</b> | 10 (ten) percent of total of each type or at least one (whichever is higher) of each type along with accessories.   | 1 Lot                                  |                |
| <b>9.3</b>   | <b>Control System (DCS, PLC etc.)</b>   |  |                |
| 9.3.1        | 2 (two) numbers each of keyboard and cursor control devices.  | 2 Nos                                  |                |
| 9.3.2        | 2 (two) numbers of LCD TFT (24") Monitors.  | 2 Nos                                  |                |
| 9.3.3        | 10 (ten) sets of spare interface cables with connecting plugs for each type of peripherals & I / O hardware.  | 1                                      |                |
| 9.3.4        | 10 (ten) percent of power supply modules of the total qty. offered for each type or 4 (four) numbers, whichever is higher.  | 1                                      |                |
| 9.3.5        | 10 (ten) percent of the total qty. offered for each type of electronic modules (I / O) or 5 (five) numbers of each electronic type of module, whichever is higher.              | 1                                      |                |
| 9.3.6        | 10 (ten) percent of total bus couplers and communication interface cards of each type or 2 (two) numbers of bus couplers and communication interface cards whichever is higher. | 1                                      |                |
| 9.3.7        | Controllers for DCS,Control panel ST,Boiler control system,Balance of plant system,PLC system/Sub-systems 10%of each type(at least 1 no. of each type) whichever is higher.     | 1                                      | For applicable |
| <b>9.4</b>   | <b>Control Valves</b>   |  |                |
| 9.4.1        | 2 sets of spare control valve stem packing for each of the control valves, as offered.  | 1 Lot                                  |                |
| 9.4.2        | 1 (one) set of spare valve trim (including cage, plug, stem, seat rings, guide bushings etc.) for both the units for each of the control valves, as offered.                    | 1 Lot                                  |                |
| <b>9.5</b>   | <b>Control valve Actuators</b>  |  |                |
| 9.5.1        | 1 (one) set of spare actuators with drive of each type and rating.  | 1 Lot                                  |                |
| 9.5.2        | 10 (ten) percent of valve positioners of each type.   | 1 Lot                                  |                |
| 9.5.3        | 10 (ten) percent of position transmitters of each type.   | 1 Lot                                  |                |



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| SL. No.      | Equipment / Package name   | Qty.   | Remarks |
|--------------|--|--|---------|
| 9.5.4        | 10 (ten) percent of limit switches/torque switches of each type. | 1 Lot  |         |
| <b>9.6</b>   | <b>Actuator</b>  |  |         |
| 9.6.1        | Complete set of Actuator   | 1No. for each type and rating  |         |
| 9.6.2        | Limit Switch   | 2 Nos each type and rating   |         |
| 9.6.3        | Torque Switch  | 2 Nos each type and rating   |         |
| 9.6.4        | Auxiliary Contact  | 1No. for each type and rating  |         |
| 9.6.5        | Motor  | 1No. for each type and rating  |         |
| 9.6.6        | Complete Seal kit  | 1Set for each type and rating  |         |
| 9.6.7        | Complete O-Ring Set  | 1Set   |         |
| <b>9.7</b>   | <b>Control Panel/Desk Mounted Items</b>                          |  |         |
| <b>9.7.1</b> | <b>Push Button</b>   |  |         |
| 9.7.1.1      | Complete assembly  | 5Nos for each colour   |         |
| 9.7.1.2      | Contact Element (1NO + 1NC) Block                                | 20Nos.   |         |
| 9.7.2        | Selector Switch  | 10Nos. for each type and rating                                      |         |
| <b>9.7.3</b> | <b>Meter (Analog or Digital)</b>                                 |  |         |
| 9.7.3.1      | Ammeter  | 10% for each type and range or minimum one (1) no. whichever is more |         |
| 9.7.3.2      | Voltmeter  | 10% for each type and range or minimum one (1) no. whichever is more |         |
| 9.7.3.3      | Frequency  | 10% for each type and range or minimum one (1) no. whichever is more |         |
| 9.7.3.4      | MW   | 10% for each type and range or minimum one (1) no. whichever is more |         |
| 9.7.3.5      | MVAR   | 10% for each type and range or minimum one (1) no. whichever is more |         |
| 9.7.3.6      | Power Factor   | 10% for each type and range or minimum one (1) no. whichever is more |         |
| 9.7.3.7      | Synchroscope   | 10% for each type and range or minimum one (1) no. whichever is more |         |
| 9.7.4        | Indicating Lamps complete assembly                               | 10Nos. for each Colour and type                                      |         |
| 9.7.5        | Mimic Lamps  | 10Nos. for each Colour and type                                      |         |
| 9.7.6        | MCB  | 2Nos. for each type and rating                                       |         |
| 9.7.7        | Door Limit Switch  | 2Nos.  |         |
| <b>9.7.8</b> | <b>Annunciation system</b>                                       |  |         |
| 9.7.8.1      | Lamp Box with Facia & Lamps (LED type)                           | 25Nos.   |         |
| 9.7.8.2      | Hooter   | 1No.   |         |
| 9.7.8.3      | Each type of PCB (for non-PLC driven system)                     | 1(one) no.   |         |
| <b>9.8</b>   | <b>ACDB</b>  |  |         |
| <b>9.8.1</b> | <b>Contactors</b>  |  |         |
| 9.8.1.1      | Power Contactor (AC)   |  |         |
| 9.8.1.1.1    | Power Contactor Complete Assembly                                | 4 Nos. for each type and rating                                      |         |
| 9.8.1.1.2    | Power Contactor spare kits                                       | 10Sets for each type and rating                                      |         |
| 9.8.1.1.3    | Power Contactor AC Coils   | 10Nos. Coils for each type and rating                                |         |



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| SL. No.      | Equipment / Package name  | Qty.   | Remarks |
|--------------|---|--|---------|
| 9.8.1.2      | Auxiliary Control Contactor (AC)  |  |         |
| 9.8.1.2.1    | Auxiliary Control Contactor Complete Assembly                           | 30 Nos.for each type and rating  |         |
| 9.8.1.2.2    | Auxiliary Control Contactor spare kits                                  | 40 Sets for each type and rating   |         |
| 9.8.1.2.3    | Auxiliary Control Contactor AC Coils                                    | 35 Nos.for each type and rating  |         |
| 9.8.2        | MCCB (Power Circuit)  | 5 Nos. for each type and rating  |         |
| 9.8.3        | MCB (Control Circuit)   | 25 Nos.for each type and rating  |         |
| <b>9.8.4</b> | <b>Switch</b>   |  |         |
| 9.8.4.1      | Local / Remote Selector Switch  | 10Nos.   |         |
| 9.8.4.2      | MCCB Status (On/off) Monitoring Switch/Contact                          | 5Nos.  |         |
| 9.8.4.3      | Trial / Normal /MCC Selector Switch                                     | 15Nos.   |         |
| 9.8.4.4      | MCC module Service Position Limit Switch                                | 5Nos.  |         |
| 9.8.5        | Thermal Overload Relay  | 5Nos. for each type and rating   |         |
| 9.8.6        | Sliding Contact (Fixed & Moving)  | 25Sets   |         |
| 9.8.7        | Bus bar to MCC module Lira Contact Assembly ( Bus-end & MCC Module-end) | 5Sets for each type and rating   |         |
| 9.8.8        | Indicating Lamps complete assembly                                      |  |         |
| 9.8.8.1      | Red   | 30Sets   |         |
| 9.8.8.2      | Amber   | 30Sets   |         |
| 9.8.8.3      | Green   | 30Sets   |         |
| 9.8.9        | Push Button (On/Off) Complete Assembly                                  | 20Sets   |         |
| 9.8.10       | CT  | 1No.for each type and rating   |         |
| 9.8.11       | Ammeter   | 1No. for each type and rating  |         |
| 9.8.12       | Control Transformer   | 1No. for each type and rating  |         |
| 9.8.13       | Off Delay/ On Delay Timer   | 5Nos.for each type and rating  |         |
| 9.8.14       | Switch Fuse Unit  | 5Nos.for each type and rating  |         |
| 9.8.15       | Terminal Block  |  |         |
| 9.8.15.1     | Power Terminal Block  | 10% of total nos. for each type and rating used in the system or minimum one (1) no. whichever is more |         |
| 9.8.15.2     | Control Terminal Block  | 10% of total nos. for each type and rating used in the system or minimum one (1) no. whichever is more |         |
| 9.8.15.3     | End Plate for Power & Control Terminal Block                            | Each type 25Nos.   |         |
| 9.8.3        | Energy Meter  | 1No. For each type &rating   |         |



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## **ANNEXURE-III**

# **PAINTING & COLOUR SCHEME**



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## 1. GENERAL

All exposed metallic surfaces subject to corrosion shall be protected by shop application of suitable coatings. Surfaces not easily accessible after shop assembly shall be treated before-hand and protected for life of the equipment. Surfaces to be finish painted after installation shall be shop painted with at least two (2) coats of primer. Steel surfaces, which are not to be painted, shall be coated with suitable rust preventive compound subject to the approval of the BHEL/Customer.

All paints shall be used in accordance with the manufacturer's instructions. No thinners or other substance shall be added to the coating material without the approval of the BHEL/Customer. The quality and vendor of the paints shall require approval of the BHEL/Customer.

All paints, when applied in a normal full coat, shall be free from runs, sags, wrinkles, patchiness, brush marks or other defects.

All primers shall be well marked into the surface, particularly in areas where pitting is evident, and the first priming coat shall be applied as soon as possible after cleaning, within four hours maximum. The paint shall be applied by brush, roller or airless spray, according to the manufacturer's instructions. Spray painting shall be carried out by operators trained and thoroughly experienced in the use of the equipment. If the drying interval between successive coats, which should not exceed one week, has been so long as to endanger the adhesion of the following coat, the paint already applied shall be lightly rubbed down with fine abrasive paper before putting on the next coat.

Paint spraying on large surfaces shall not normally be done indoors, except with the approval of the BHEL/Customer. Spray guns shall not be used outdoors in windy weather or near unprotected surfaces of a contrasting colour and under no circumstances shall spray guns be used where spray may be carried into or onto exposed electrical equipment.

Paint containers shall not be opened until required and the paint shall be mechanically mixed thoroughly before use, and agitated occasionally during use.

Electrical equipment shall be shop finished with one or more coats of primer and two coats of high-grade oil resistant enamel. The interior of all panels' cabinets and enclosures shall be finished with gloss white enamel.

The Bidder shall furnish sufficient touch-up paint for one complete finish coat on all exterior factory surfaces of each item of equipment. The touch-up paint shall be of the same type and colour as the factory applied paint and shall be carefully packed to avoid damage during shipment. Complete painting instructions shall be furnished.

Shop primer for steel and iron surfaces which will have a continuous operating temperature below 35 Deg.C shall be selected by the Bidder, in accordance to the relevant standard. Special high temperature primer shall be used on surface exposed to operating temperature above 35 Deg.C.

The colour scheme shall be submitted during execution of contract for approval by the BHEL/Customer.

## 2. PREPARATION

Oil and grease shall be removed from the surface by washing with a suitable detergent, rinsing with clean water, and drying.

Surfaces to be shot blasted shall be cleaned to Swedish Standard SA 2.5 or equivalent, and all dust remaining after cleaning shall be removed.

The priming coat shall be applied without delay.

## 3. DAMAGED PAINTWORK

Any damaged paintwork shall be made good as follows:



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- a) The damaged area, together with an area extending 25mm around its boundary, shall be cleaned down to bare metal.
- b) A priming coat shall be immediately applied, followed by a full paint finish equal to that originally applied and extending 50mm around the perimeter of the original damage.
- c) The repainted surface shall present a smooth surface. This shall be obtained by carefully chamfering the paint edges before and after priming.

#### **4. PAINTING SYSTEMS**

The requirements for the dry film thickness (DFT) of paint and the materials to be used shall be as stated below, unless otherwise specified elsewhere in this specification.

##### **a) Surfaces Subject To Weathering**

All surfaces shall have a minimum of four coats of paint made up as follows :

|                         |   |                        |
|-------------------------|---|------------------------|
| Primer coat             | : | 35 micron DFT          |
| Tie coat                | : | 35 micron DFT          |
| Finishing coat (2 Nos.) | : | 35 micron DFT per coat |

The total minimum DFT shall be 140 micron.

##### **b) Surfaces Inside Buildings**

All surfaces shall have a minimum of three coats of paint made up as follows:

|                         |   |                        |
|-------------------------|---|------------------------|
| Primer coat             | : | 35 micron DFT          |
| Tie coat                | : | 35 micron DFT          |
| Finishing coat (2 Nos.) | : | 25 micron DFT per coat |

The total minimum DFT shall be 120 micron.

The type and colour of primer & finish coat shall be selected by the Bidder after approval by the BHEL/Customer.

#### **5. COLOUR CO-ORDINATION & FINISH**

- Exterior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and with the surrounding landscape.
- Interior surfaces throughout the plant shall be finished in colours and textures which will blend harmoniously together and which will be conducive to; the comfort, well-being and high productivity of the operators. Operating plant and services provided shall be colour coded for ease of identification.
- All finishes shall be durable and as far as possible maintenance free. Finishes shall be easily cleaned.
- Final colours and finishes shall be to the Approval of the BHEL/Customer.

Note: The above mentioned painting requirement is bare minimum. However any additional requirement as per insistence of BHEL / Customer shall be provided by the bidder without any price and delivery implication to BHEL.



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## **ANNEXURE-IV**

### **LIST OF TOOLS & TACKLES**

## VOLUME : IIA

## SECTION-VIII

REQUIREMENTS OF SPARES, TOOLS & TACKLE,  
LUBRICANTS/OIL/CONSUMABLES

## 1.00.00 TOOLS &amp; TACKLE

The Contractor shall supply with the equipment one complete set of special tools and tackles required for the erection, assembly, dis-assembly & maintenance of the equipment. These special tools will also include special material handing equipment, jigs & fixtures for maintenance and calibration/ re-adjustment, checking & measurement aids etc. A list of such tools & tackles shall be submitted by the Bidder along with the offer. Detailed description of each tool/tackles, its function along with the equipment/part for which it is meant for and the price of each tool/tackles shall also be indicated in the offer. These tools & tackles shall be separately packed and sent to site before the first unit commissioning. The Bidder shall also ensure that these tools are not used for erection purpose.

## 2.00.00 SPARES

## 2.01.00 General

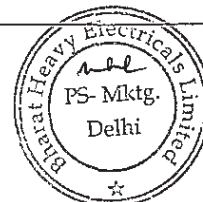
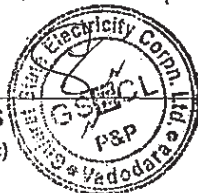
The Bidder shall indicate and include in his scope of supply all the necessary start-up, commissioning and recommended spares in addition to mandatory spares as specified elsewhere in the specification. The Owner reserves the right to buy any or all mandatory and recommended spares. The Contractor shall also state for each item of spares both mandatory and recommended, the normal expected service life.

2.01.01 All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended to replace. The spares shall be treated and packed for long storage under the climatic conditions prevailing at the site, e.g. small items shall be packed in sealed transparent plastic bags with dessicator packs as necessary.

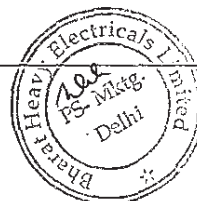
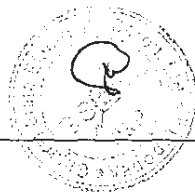
2.01.02 Each spare part shall be clearly marked or labelled on the outside of the packing with the description. When more than one spare part is packed in a single case, a general description of the contents shall be shown on the outside and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.

2.01.03 All cases, containers or other packages are liable to be opened for examination as may be considered necessary by the Engineer.

2.01.04 All mandatory spares shall be delivered to site within one to three months prior to the scheduled date of the trial operation of the plant. However, they shall not be despatched before the despatch of the associated main equipment.

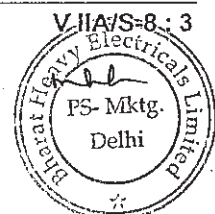


- 2.01.05 The Bidder shall also guarantee supply of spare parts, which will be made, based on manufacturer's drawings on special order from the Purchaser for 30 years after commissioning of the plant.
- 2.01.06 Warranty period for all kinds of spares shall be six thousand (6000) hours of operation, except normal wear or eighteen (18) months from the date of receipt at site, whichever is later. In case of failure or non-conformance to specifications, the Contractor shall replace them free of cost.
- 2.02.00 **Recommended Spares**
- 2.02.01 The Contractor shall provide a list of recommended spares giving unit prices and total prices for 2 years of normal operation of the plant for spares of indigenous origin, and for 5 years of normal operation for spares of non-indigenous origin. This list shall take into consideration the mandatory spares specified elsewhere in the specification and should be a separate list.
- 2.02.02 The price of recommended spares will not be used for the evaluation of bids. The price of these spares shall remain valid for a period as specified elsewhere in the specification from the date of Award of the Contract. Where the recommended spares are the same as mandatory spares, the prices shall be the same. The prices of any recommended spares, which are not common with mandatory spares, shall be subject to review by the Owner, and shall be finalised after mutual discussion.
- 2.03.00 **Start-up Commissioning Spares**
- 2.03.01 Start-up commissioning spares are those spares which may be required during the start-up and commissioning of the equipment/system. All spares used until the plant is handed over to the Owner shall come under this category. Said spares, properly marked, shall be supplied together with the main equipment and shall be used by the Contractor, if needed, during erection & commissioning stage. All such spares which remain unused till issuance of Taking Over Certificate by the Owner, along with an equipment-wise quantitative consumption report shall be returned to the Owner during time of handover. The list of commissioning spares to be brought by the Contractor to ensure smooth commissioning of the plant shall be subject to the Engineer's approval.
- 2.03.02 The Contractor shall submit a complete list of all such start-up spares. Costs of the above spares, which are consumed before the handing-over of the plant, shall be deemed to have been included in the lump sum proposal price of the package, and the Contractor shall have no claim on this account to the Owner.
- 2.04.00 **Mandatory Spare Parts**
- 2.04.01 The Owner considers some of the spares are essential for running the equipment irrespective of whether they are included in the list of recommended spares by the Bidder as mentioned above.



Since the components involved can not be foreseen at the bidding stage, only broad requirements of the Owner in this respect are outlined hereinafter. The bidder shall include his proposal, on the basis of this guideline, an item-wise list of all components and the quantity, unit prices & total price thereof, offered as mandatory spares for each and every equipment. This list shall be separate from the list of recommended spares and shall be used for bid evaluation purposes. Any clarification in this respect may be obtained by the Bidder at the pre-bidding stage.

- 2.04.02 Since the components involved can not be foreseen at the bidding stage, only broad requirements of the Owner in this respect are outlined hereinafter. The Bidder shall include in his proposal, on the basis of these guidelines, an item-wise list of all components and the quantity, unit prices & total price thereof, offered as mandatory spares for each and every equipment. This list shall be separate from the list of recommended spares and shall be used for bid evaluation purposes. Any clarification in this respect may be obtained by the Bidder at the pre-bidding stage.
- 2.04.03 The mandatory spares should be supplied to the Owner at least one month before the trial run. The despatch programme is subject to approval of the Owner/Consultant after award of contract.
- 2.02.04 Criteria for selection of Quantity of Mandatory Spares :
- For Mandatory Spares refer Annexure-I.
- 2.04.05 Purchaser will have the option to procure any or all of the mandatory spares at his discretion.





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## **ANNEXURE-V**

### **CLARIFIED WATER ANALYSIS**



**TITLE:**  
**1X800 MW WANAKBORI STPP**  
**TECHNICAL SPECIFICATION FOR**  
**CONDENSATE POLISHING UNIT**

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### CLARIFIED WATER ANALYSIS

| CONSTITUENTS                       | As                      | CONTENT                    |
|------------------------------------|-------------------------|----------------------------|
| Calcium                            | CaCO <sub>3</sub>       | 85.0 ppm                   |
| Magnesium                          | CaCO <sub>3</sub>       | 94.0 ppm                   |
| Sodium & Potassium                 | CaCO <sub>3</sub>       | 75.0 ppm                   |
| Iron in Soln.                      | Fe                      | 0.05 ppm                   |
| Hydrogen (FMA)                     | CaCO <sub>3</sub>       | NIL                        |
| <b>TOTAL CATIONS (except iron)</b> | <b>CaCO<sub>3</sub></b> | <b>254.0 ppm</b>           |
| Bicarbonate                        | CaCO <sub>3</sub>       | 160.0 ppm                  |
| Carbonate                          | CaCO <sub>3</sub>       | NIL                        |
| Hydroxide                          | CaCO <sub>3</sub>       | NIL                        |
| Sulphate                           | CaCO <sub>3</sub>       | 20.0 ppm                   |
| Chloride                           | CaCO <sub>3</sub>       | 52.0 ppm                   |
| Nitrate                            | CaCO <sub>3</sub>       | 22.0 ppm                   |
| Phosphate                          | CaCO <sub>3</sub>       | NIL                        |
| Fluoride                           | CaCO <sub>3</sub>       | NIL                        |
| <b>TOTAL ANIONS</b>                | <b>CaCO<sub>3</sub></b> | <b>254.0 ppm</b>           |
| Reactive Silica                    | SiO <sub>2</sub>        | 22.0 ppm                   |
| Colloidal Silica                   | SiO <sub>2</sub>        | NIL                        |
| Conductivity at 25 degree Celsius  |                         | 440 Microsiemens/cm (max)  |
| pH value at 25 degree Celsius      | -                       | 7.5 – 8.0                  |
| Turbidity                          |                         | Not to exceed 15 NTU (max) |

#### Notes:

- 1) The Cycle of Concentration of Cooling water shall be 5.0. Bidder to derive the Cooling water analysis accordingly and design the Condensate Polishing Unit for Condenser tube leakage condition accordingly.
- 2) The above clarified water analysis shall be used to design the Condensate Polishing Unit for Condenser tube leakage condition.



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## **ANNEXURE-VI DRAWINGS/DOCUMENTS SUBMISSION PROCEDURE**



|   |                                       |
|---|---------------------------------------|
| <b>TITLE:</b><br><b>1X800 MW WANAKBORI STPP</b><br><b>TECHNICAL SPECIFICATION FOR</b><br><b>CONDENSATE POLISHING UNIT</b> | SPECIFICATION NO.: PE-TS-408-155-A001 |
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## DRAWING / DOCUMENT DISTRIBUTION SCHEDULE

### DISTRIBUTION SCHEDULE

| S. No | Description                            | GSECL (CUSTOMER)  |                    |                                |                |               |                |               |                 |         |      | M/S DCPL, KOLKATA |         |     | Equipment Vendor | Remarks |      |
|-------|--|-------------------|--------------------|--------------------------------|----------------|---------------|----------------|---------------|-----------------|---------|------|-------------------|---------|-----|------------------|---------|------|
|       |  | Director Projects | Director Technical | CE/Civil Thermal Projects Hyd. | CE/ TPC-I, Hyd | CE/ O&M/ KTPS | SE/ Civil KTPS | SE/E&M / KTPS | DE Constr. KTPS | Kolkata | HYD  | KTPS              | Kolkata | HYD |                  |         | KTPS |
| A     | Letter Of Intent or Contract Documents | 1                 | 1                  | 1                              | S              | 1             | 1              | 2             | 2               | 1       | 1    | 1                 | 1       | 1   | 1                | 2       |      |
| B     | Vendor Drawings                        |                   |                    |                                |                |               |                |               |                 |         |      |                   |         |     |                  |         |      |
| 1.    | Preliminary                            | 1                 | 1                  | 1                              | 2              | 1             | 1              | 1             | 2               | 2       | 12   | 1                 | -       | -   | -                | 5       |      |
| 2.    | Return preliminary with comments       | -                 | -                  | 1                              | 2              | 1             | 1              | 1             | 1               | 1       | 5    | 1                 | -       | -   | -                | 1       |      |
| 3.    | Final and any revision thereof         |                   |                    |                                |                |               |                |               |                 |         |      |                   |         |     |                  |         |      |
|       | a. Civil                               | 1                 | 1                  | 6+1T                           | 1              | 1             | 1              | 6+1T          | 1               | 1       | 2+1T | 1                 | 1       | 1   | 5                |         |      |
|       | b. E&M                                 | 1                 | 1                  | 1                              | 6+1T           | 1             | 1              | 1             | 6+1T            | 1       | 2+1T | 1                 | 1       | 1   | 5                |         |      |
| C.    | Design Drawings                        |                   |                    |                                |                |               |                |               |                 |         |      |                   |         |     |                  |         |      |
| 1.    | Preliminary                            |                   |                    |                                |                |               |                |               |                 |         |      |                   |         |     |                  |         |      |
|       | a. Civil                               | 1                 | 1                  | 2                              | 1              | 1             | 1              | 2             | 1               | 1       | 4    | 1                 | 1       | 1   | 5                |         |      |
|       | b. E&M                                 | 1                 | 1                  | 1                              | 2              | 1             | 1              | 1             | 2               | 1       | 4    | 1                 | 1       | 1   | 5                |         |      |
| 2.    | Released for construction              |                   |                    |                                |                |               |                |               |                 |         |      |                   |         |     |                  |         |      |
|       | a. Civil                               | 1                 | 1                  | 2                              | 1              | 1             | 1              | 6             | 1               | 1       | 1    | 1                 | 1       | 2   | 5                |         |      |
|       | b. E&M                                 | 1                 | 1                  | 1                              | 1              | 2             | 1              | 1             | 6               | 1       | 1    | 1                 | 1       | 2   | 5                |         |      |
| 3.    | Return marked 'As built'               |                   |                    |                                |                |               |                |               |                 |         |      |                   |         |     |                  |         |      |
|       | a. Civil                               | -                 | -                  | 1                              | -              | -             | -              | 1             | -               | -       | 1    | 1                 | 1       | S   | 1                |         |      |
|       | b. E&M                                 | -                 | -                  | -                              | 1              | -             | -              | -             | 1               | -       | 1    | 1                 | 1       | S   | 1                |         |      |
| 4.    | As built drawings                      |                   |                    |                                |                |               |                |               |                 |         |      |                   |         |     |                  |         |      |
|       | a. Civil                               | -                 | -                  | 1+1T                           | -              | 2+1T          | 2+1T           | 5+1T          | -               | -       | 1+1T | -                 | -       | 1   | 5                |         |      |
|       | b. E&M                                 | -                 | -                  | 1                              | 2+1T           | 2+1T          | 2+1T           | 5+1T          | -               | -       | 1+1T | -                 | -       | 1   | 5                |         |      |



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| S. No | Description                         | GSECL (CUSTOMER)  |                    |                                |               |              |               |               |                 |         |     | M/S DCPL, KOLKATA |         |     | Equipment Vendor | Remarks |      |  |
|-------|-------------------------------------|-------------------|--------------------|--------------------------------|---------------|--------------|---------------|---------------|-----------------|---------|-----|-------------------|---------|-----|------------------|---------|------|--|
|       |                                     | Director Projects | Director Technical | CE/Civil Thermal Projects Hyd. | CE/TPC-I, Hyd | CE/O&M/ KTPS | SE/Civil KTPS | SE/E&M / KTPS | DE Constr. KTPS | Kolkata | HYD | KTPS              | Kolkata | HYD |                  |         | KTPS |  |
| D     | Progress Report Monthly             |                   |                    |                                |               |              |               |               |                 |         |     |                   |         |     |                  |         |      |  |
| 1.    | Equipment vendor                    | 1                 | 1                  | 1                              | 2             | 1            | 1             | 1             | 1               | 2       | 1   | 1                 | 1       | 1   | 1                | 1       | S    |  |
| 2.    | M/s DCPL, Kolkata                   | 1                 | 1                  | 2                              | 2             | 1            | 1             | 1             | 1               | 2       | 1   | 1                 | 1       | 1   | 1                | 1       | Nil  |  |
| E     | Test & Inspection Reports           |                   |                    |                                |               |              |               |               |                 |         |     |                   |         |     |                  |         |      |  |
| 1.    | Equipment manufacturer              |                   |                    |                                |               |              |               |               |                 |         |     |                   |         |     |                  |         |      |  |
| a.    | Civil                               | 1                 | 1                  | 1                              | 2             | 1            | 1             | 1             | 1               | 1       | -   | 11                | 1       | 1   | 1                | S       |      |  |
| b.    | E&M                                 | 1                 | 1                  | -                              | 2             | 1            | 1             | 1             | -               | 1       | 1   | 11                | 1       | 1   | 1                | S       |      |  |
| 2.    | M/s DCPL, Kolkata                   | 1                 | 1                  | -                              | 2             | 1            | 1             | 1             | -               | 1       | 1   | 5                 | -       | 1   | 1                | -       |      |  |
| F     | Instruction Manuals/Data Books      |                   |                    |                                |               |              |               |               |                 |         |     |                   |         |     |                  |         |      |  |
| 1.    | Equipment manufacturer              |                   |                    |                                |               |              |               |               |                 |         |     |                   |         |     |                  |         |      |  |
| a.    | Civil                               | 1                 | 1                  | 1+1T                           | 1             | 1            | 1             | 1             | 6+1T            | 1       | 1   | 2+1T              | 1       | 1   | 1                | S       |      |  |
| b.    | E&M                                 | 1                 | 1                  | -                              | 3+1T          | 1            | 1             | 1             | -               | 6+1T    | 2   | 3+1T              | 1       | 1   | 1                | S       |      |  |
| 2.    | M/s DCPL, Kolkata                   | 1                 | 1                  | -                              | 10+1T         | 1            | 1             | 1             | -               | 15+1T   | -   | S                 | 1       | 1   | 1                | Nil     |      |  |
| G     | M/s DCPL, Kolkata Criteria          | 1                 | 1                  | 1                              | 8+1T          | 1            | 1             | 1             | 1               | 2       | 1   | 1                 | 1       | 1   | 1                | S       |      |  |
| H     | Design Calculations                 | 1                 | 1                  | 1                              | 8+1T          | 1            | 1             | 1             | 1               | 2       | 1   | 1                 | 1       | 1   | 1                | S       |      |  |
| I     | Final consulting Engineering Report | 1                 | 1                  | 1                              | 10            | 1            | 1             | 1             | 1               | 2       | 1   | S                 | 1       | 1   | 1                | Nil     |      |  |

S – Source, T – Transparency & Soft Copy on CD,

Initial submission of drawings / documents will be in soft format (pdf & auto cad as required by BHEL) through email followed by Seven (07) hard copies.

**Note:**

- Quantity of prints may change during detailed engineering stage based on BHEL / Customer requirement. However the same will be adhered by the bidder without any delivery/commercial implication to BHEL.
- All the drawing documents along with the O&M manual (of all the revisions) are necessarily to be submitted in soft copies in addition to hard copies.
- Bidder to submit soft copies of all the drawing and document along with quality plans for BHEL review and approval.
- The date of submission of drawing documents shall be considered as the date of submission of hard and soft copies whichever is later.

|  |   |                                       |
|--|---|---------------------------------------|
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- All the drawings shall be prepared on computer auto cad and other documents (like datasheet etc.) on MS office software. Bidder not complying to the requirement shall not be considered. For the execution of the contract regular meeting (generally once in 15 days or as per project requirement) is required.
- Bidder has to come for meeting with the concerned dealing persons as per BHEL or customer requirement in a short notice.
- Bidder to submit instrument schedule, cable schedule and valve schedule in MS- Excel format during detailed engineering.
- Bidder to also furnish the auto cad copy / MS-word (as applicable)/MS-Excel (as applicable) of the following documents after award of contract. However any other auto cad copy/MS-Excel/MS-word of any other document as per the insistence of BHEL / customer will also be submitted by the bidder without any delivery/commercial implication to BHEL.
  - P&IDs.
  - Equipment lay out.
  - Equipment Cable tray layout.
  - Civil scope drawings.
  - Piping lay out drawing.
  - Valve schedule.
  - Instrument schedule.



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## **ANNEXURE-VII**

### **INSPECTION AND TESTING**



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**CONDENSATE POLISHING UNITS**

| Items / Components                             | Tests/Check | Material Test  | WPS/PQR/Welder Qualification | DPT/MP         | Assembly Fit up | Dimension | RT             | Hydraulic #/ Water Fill | Performance Test | Test as per relevant Standard/ Approved Data Sheets | Other Tests    | Remarks  |
|--|-------------|----------------|------------------------------|----------------|-----------------|-----------|----------------|-------------------------|------------------|---|----------------|--|
|  |             |                |                              |                |                 |           |                |                         |                  |   |                |  |
| <b>1. HORIZONTAL CENTRIFUGAL PUMPS</b>         |             |                |                              |                |                 |           |                |                         |                  |   |                |  |
| 1.1. Casing                                    |             | Y <sup>a</sup> |                              | Y <sup>a</sup> |                 |           |                | Y                       |                  | Y   |                | As Applicable  |
| 1.2. Impeller                                  |             | Y <sup>a</sup> |                              | Y <sup>a</sup> |                 |           |                |                         |                  |   | Y <sup>a</sup> | One per Heat/Heat Treatment batch./Lot   |
| 1.3. Shaft                                     |             | Y <sup>a</sup> |                              | Y              |                 |           |                |                         |                  | Y <sup>a</sup>                                      |                | On machined surfaces only. Also 100% on Butt Welds & 10% on Fillet Welds.  |
| <b>2. VERTICAL PUMPS</b>                       |             |                |                              |                |                 |           |                |                         |                  |   |                |  |
| 2.1. Casing                                    |             | Y <sup>a</sup> |                              | Y <sup>a</sup> |                 | Y         |                | Y                       | Y <sup>1</sup>   | Y   |                | UT shall be done for shafts with Diameter 50 mm or above & Plates of Thickness 20 mm or above.   |
| 2.2. Impeller                                  |             | Y <sup>a</sup> |                              | Y <sup>a</sup> |                 |           |                |                         |                  |   | Y <sup>a</sup> | Dynamic Balancing per ISO: 1940, Grade 6.3 minimum.  |
| 2.3. Shaft                                     |             | Y <sup>a</sup> |                              | Y              |                 |           |                |                         |                  | Y <sup>a</sup>                                      |                | As per HIS, USA. / API 598 (In case of Metering Pump)  |
| 2.4. Fabricated Parts                          |             | Y <sup>a</sup> |                              | Y <sup>a</sup> |                 |           | Y <sup>2</sup> | Y                       |                  | Y <sup>a</sup>                                      |                | 10% RT to be conducted on butt welds for plate Thickness >=10 mm.  |
| <b>3. DOSING/ METERING PUMPS</b>               |             |                |                              |                |                 |           |                |                         |                  |   |                |  |
| 4. GATE/ GLOBE/ CHECK VALVES                   |             | Y <sup>a</sup> |                              | Y <sup>a</sup> |                 | Y         |                | Y                       | Y <sup>1</sup>   | Y   | Y <sup>a</sup> | Seat Leakage Test for actuator operated valves shall be done by closing the valve with job actuator.   |
| 5. DIAPHRAGM VALVES                            |             | Y <sup>a</sup> |                              |                |                 | Y         |                | Y <sup>3</sup>          | Y                | Y   | Y <sup>a</sup> | Tests on Rubber Diaphragms per batch of Rubber mix such as Tensile, Elongation, Hardness, Thickness, Bleed Resistance, Flex Test for 1500 cycles etc. shall be conducted. In addition, Type Test for 50,000 cycles for each type of diaphragm shall also be conducted, if not carried out earlier. |
| 6. BUTTERFLY VALVES (LOW PR.)                  |             | Y <sup>a</sup> |                              | Y <sup>a</sup> |                 | Y         |                | Y <sup>3</sup>          | Y                |   |                | Blue Matching, Wear Travel for Gate Valves, reduced pressure test for check valves shall be conducted per relevant standards.  |
| 6.1 Body (Cast)                                |             | Y <sup>a</sup> |                              | Y <sup>a</sup> |                 |           |                |                         |                  |   |                |  |
| 6.2 Disc (Cast)                                |             | Y <sup>a</sup> |                              | Y <sup>a</sup> |                 |           |                |                         |                  |   |                |  |
| 6.3 Shaft                                      |             | Y <sup>a</sup> |                              | Y <sup>a</sup> |                 | Y         |                |                         |                  |   |                |  |
| <b>7. PLUG/ BALL VALVES (LOW PR.)</b>          |             |                |                              |                |                 |           |                |                         |                  |   |                |  |
| 8. BLOWERS                                     |             | Y <sup>a</sup> |                              | Y <sup>a</sup> |                 | Y         |                | Y                       | Y                | Y   | Y <sup>a</sup> |  |
| 9. ATMOSPHERIC STORAGE TANKS/ PRESSURE VESSELS |             | Y <sup>a</sup> |                              | Y <sup>a</sup> |                 | Y         |                | Y                       |                  | Y   | Y <sup>a</sup> |  |



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| Items / Components           | Tests/Check   |                              |                |                 |           |                |                        |                  |   |                 | Remarks        |   |
|------------------------------|---|------------------------------|----------------|-----------------|-----------|----------------|------------------------|------------------|---|-----------------|----------------|---|
|                              | Material Test   | WPS/PQR/Welder Qualification | DPT/MPI        | Assembly Fit up | Dimension | RT             | Hydraulic / Water Fill | Performance Test | Test as per relevant Standard/ Approved Data Sheets | Other Tests     |                |   |
| 10. RUBBER LINING            | Y <sup>a</sup>  |                              |                | Y               | Y         |                |                        |                  | Y   | Y <sup>10</sup> | Y <sup>7</sup> | Heat Treatment of the Tank/Vessel shall be done per fabrication code requirement. Dished ends shall be stress relieved.<br><br>RT as per fabrication code requirements. Dished end, if fabricated by butt welding of two plates or more then that butt weld joint(s) shall be subjected to 100% RT.<br><br>100% RT shall be carried out on butt weld joints coming under tension load and 25% RT shall be carried out on butt weld joints coming under compression load. In case rope drum & brake drum are fabricated then 100% RT shall be carried out on longitudinal & circumferential weld joints. |
| 11. BUTTERFLY VALVES (HP)    | Y <sup>a</sup>  |                              |                | Y               | Y         |                | Y                      | Y                | Y   |                 |                |   |
| 12. BALL VALVES (HP)         | Y <sup>a</sup>  |                              |                | Y               | Y         |                | Y                      | Y                |   |                 |                |   |
| 13. RESINS/ ACTIVATED CARBON | Y <sup>a</sup>  |                              |                | Y               | Y         |                |                        |                  | Y   | Y <sup>11</sup> | Y <sup>8</sup> |   |
| 14. AGITATORS                | Y <sup>a</sup>  | Y                            | Y <sup>e</sup> | Y               | Y         |                |                        | Y                | Y   | Y <sup>11</sup> |                |   |
| 15. PIPING                   | Y <sup>a</sup>  | Y                            | Y <sup>e</sup> | Y               | Y         |                | Y <sup>12</sup>        |                  | Y   |                 |                |   |
| 16. VENTILATION/EXHAUST FAN  | Y <sup>a</sup>  |                              | Y <sup>e</sup> | Y               | Y         |                | Y <sup>13</sup>        | Y                | Y   | Y <sup>14</sup> | Y <sup>8</sup> |   |
| 17. DUAL PLATE CHECK VALVE   | Y <sup>a</sup>  |                              | Y <sup>e</sup> | Y               | Y         |                | Y                      | Y                | Y   | Y <sup>14</sup> |                |   |
| 18. HOISTS & CRANES          | Y <sup>a</sup>  | Y                            | Y <sup>e</sup> | Y               | Y         | Y <sup>e</sup> |                        | Y                | Y   |                 |                |   |
| Y <sup>10</sup>              | Rubber Lining Mix shall be subjected to Bleed Resistance Test on moulded sample. Adhesion, Spark and Hardness Test for the Rubber lined jobs shall also be conducted.   |                              |                |                 |           |                |                        |                  |   |                 |                |   |
| Y <sup>11</sup>              | Gear Boxes shall be checked for smooth No Load Operation at shop to verify noise and vibration levels. Gear Ratio and Kerosene Leak Test shall also be conducted.   |                              |                |                 |           |                |                        |                  |   |                 |                |   |
| Y <sup>12</sup>              | After erection, the complete Piping system alongwith valves & fittings shall be hydrostatically tested at 1.5 times the design pressure or 2 times the working pressure which ever is higher.   |                              |                |                 |           |                |                        |                  |   |                 |                |   |
| Y <sup>13</sup>              | One Fan of each type & size shall be routine performance tested as per corresponding code for air flow, static pressure, total pressure, speed, efficiency, power consumption, noise & temperature rise. Also all Fans shall be subjected to run test of 4 hours during which noise, vibration, temperature rise and current drawn shall be measured. |                              |                |                 |           |                |                        |                  |   |                 |                |   |
| Y <sup>14</sup>              | Blue Matching for metal to metal contact, reduced pressure test for check valves shall be conducted per relevant standards. Dry cycle test on valve spring for 1, 00,000 cycles shall be carried out as type test, if not carried out earlier, for the similar MOC, size and type of spring.  |                              |                |                 |           |                |                        |                  |   |                 |                |   |
| #                            | For valves, Hydraulic test includes body and seat leakage, back seat test, disc strength test etc. as per applicable code.  |                              |                |                 |           |                |                        |                  |   |                 |                |   |

Note:1) The above mentioned requirement are bare minimum. However any additional comments provided by BHEL / Customer shall be adhered by successful bidder without any commercial and delivery implication to BHEL/Customer.



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**ANNEXURE-VIII**  
**MASTER DRAWING LIST**  
**WITH SCHEDULE OF SUBMISSION**



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### DRAWING/DOCUMENTS SUBMISSION SCHEDULE

After award of LOI/LOA, following minimum drawing/documents shall be submitted by the bidder for BHEL/Customer approval. However any additional drawing/document if found necessary for completion of the engineering, the same shall be submitted by bidder without any commercial & delivery implication to BHEL. For the Drawings/Documents Submission Procedure, please refer below mentioned ANNEXURE-A. Bidder has to submit the revised drawing/document along with the compliance sheet indicating enumerate reply to all BHEL and customer comments or observations. Without compliance sheet the submission of the drawings/documents will not be considered and the delay on this account will be solely on bidder's side only. The number of drawing/documents to be submitted by the bidder shall be as per ANNEXURE-VI.

Every revised submission incorporating comments shall be resubmitted within 7 days.

BHEL shall provide observation / approval within 15 days from the date of document submission by bidder.

Bidder to note that drawings submitted shall be complete in all respects with revised drawing submitted incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. Engineering meeting shall be held fort nightly, for which the bidder shall depute his concerned engineers along with project manager to PEM office or at customer office without fail.

### ANNEXURE – A

| MASTER DRAWING LIST(MDL) |                      |  |   |                         |
|--------------------------|----------------------|--|---|-------------------------|
| S.No.                    | Drawing/Document No. | Drawing/Document Title   | No. of weeks for drawing/document submission after placing LOI/PO | Paper Size of Dwg/Docs. |
| 1.                       | PE-V2-408-155A-A001* | P& I DIAGRAM OF CONDENSATE POLISHING UNIT  | 4   | A1                      |
| 2.                       | PE-V2-408-155A-A002* | EQUIPMENT LAYOUT OF CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA )   | 4   | A1                      |
| 3.                       | PE-V2-408-155A-A003* | EQUIPMENT LAYOUT OF CONDENSATE POLISHING UNIT (REGENERATION AREA)  | 4   | A1                      |
| 4.                       | PE-V2-408-155A-A004* | PROCESS DESIGN AND SIZING CALCULATIONS , DATA SHEET OF RESIN VESSEL THICKNESS AND PRESSURE DROP CALCULATIONS FOR CPU | 4   | A4                      |
| 5.                       | PE-V2-408-155A-A005* | SUB-VENDOR LIST AND INSPECTION CRITERIA  | 4   | A4                      |
| 6.                       | PE-V2-408-155A-A006* | OPERATION & CONTROL PHILOSOPHY FOR CPU ALONG WITH CONTROL SYSTEM CONFIGURATION DIAGRAM                               | 6   | A4                      |
| 7.                       | PE-V2-408-155A-A007  | CIVIL ASSIGNMENT DRAWING OF CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA)  | 8   | A1                      |
| 8.                       | PE-V2-408-155A-A008  | CIVIL ASSIGNMENT DRAWING OF CONDENSATE POLISHING UNIT REGENERATION AREA)   | 8   | A1                      |
| 9.                       | PE-V2-408-155A-A009  | PIPING LAYOUT (REGENERATION AREA )   | 10  | A1                      |
| 10.                      | PE-V2-408-155A-A010  | PIPING LAYOUT (SERVICE VESSEL AREA)  | 10  | A1                      |



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|-----|---------------------|---|----|----|
| 11. | PE-V2-408-155A-A011 | ELECTRICAL LOAD DATA  | 10 | A4 |
| 12. | PE-V2-408-155A-A012 | GA DRAWING OF SERVICE VESSELS FOR CPU                           | 10 | A1 |
| 13. | PE-V2-408-155A-A013 | QAP FOR SERVICE VESSEL  | 10 | A4 |
| 14. | PE-V2-408-155A-A014 | GA DRAWING OF PRESSURE VESSELS FOR CPU                          | 10 | A1 |
| 15. | PE-V2-408-155A-A015 | QAP FOR PRESSURE VESSELS  | 10 | A4 |
| 16. | PE-V2-408-155A-A016 | GA DRAWING OF ATMOSPHERIC TANKS FOR CPU                         | 10 | A1 |
| 17. | PE-V2-408-155A-A017 | QAP FOR ATMOSPHERIC TANKS                                       | 10 | A4 |
| 18. | PE-V2-408-155A-A018 | TECHNICAL DATA SHEET OF HORIZONTAL / VERTICAL CENTRIFUGAL PUMPS | 10 | A4 |
| 19. | PE-V2-408-155A-A019 | TECHNICAL DATA SHEET FOR METERING PUMPS                         | 10 | A4 |
| 20. | PE-V2-408-155A-A020 | TECHNICAL DATA SHEET OF BLOWERS                                 | 10 | A4 |
| 21. | PE-V2-408-155A-A021 | TECHNICAL DATA SHEET FOR MOTOR                                  | 10 | A4 |
| 22. | PE-V2-408-155A-A022 | QAP FOR HORIZONTAL / VERTICAL CENTRIFUGAL PUMPS WITH MOTOR      | 10 | A4 |
| 23. | PE-V2-408-155A-A023 | QAP FOR METERING PUMPS WITH MOTORS                              | 10 | A4 |
| 24. | PE-V2-408-155A-A024 | QAP FOR BLOWERS WITH MOTORS                                     | 10 | A4 |
| 25. | PE-V2-408-155A-A025 | TECHNICAL DATA SHEET FOR HIGH PRESSURE VALVES                   | 10 | A4 |
| 26. | PE-V2-408-155A-A026 | TECHNICAL DATA SHEET FOR LOW PRESSURE VALVES                    | 10 | A4 |
| 27. | PE-V2-408-155A-A027 | QAP FOR VALVES  | 10 | A4 |
| 28. | PE-V2-408-155A-A028 | TECHNICAL DATA SHEET FOR INSTRUMENTS                            | 10 | A4 |
| 29. | PE-V2-408-155A-A029 | TECHNICAL DATA SHEET FOR ANALYZERS                              | 10 | A4 |
| 30. | PE-V2-408-155A-A030 | TECHNICAL DATA SHEET FOR HEATER AND RESIN                       | 10 | A4 |



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| 31. | PE-V2-408-155A-A031  | VALVE SEQUENCE CHART   | 10 | A3                     |
| 32. | PE-V2-408-155A-A032  | INSTRUMENT SCHEDULE  | 12 | A3                     |
| 33. | PE-V2-408-155A-A033  | VALVE SCHEDULE   | 12 | A3                     |
| 34. | PE-V2-408-155A-A034* | CABLE TRAY/TRENCH & CONDUIT ROUTING AND EARTHING LAYOUT DIAGRAM FOR CONDENSATE POLISHING UNIT (REGENERATION AREA)  | 12 | A1                     |
| 35. | PE-V2-408-155A-A035* | CABLE TRAY/TRENCH & CONDUIT ROUTING AND EARTHING LAYOUT DIAGRAM FOR CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA)  | 12 | A1                     |
| 36. | PE-V2-408-155A-A036  | DATASHEET OF RESIN TRAP, CARBON TRAP, ACF, AGITATOR  | 12 | A4                     |
| 37. | PE-V2-408-155A-A037  | GA OF BATTERY BANK AND CHARGER   | 12 | A4                     |
| 38. | PE-V2-408-155A-A038  | PLC DOCUMENTS FOR DM PLANT--GA & WIRING DETAILS OF PLC PANEL, I/O LIST, BOM, MIMIC DIAGRAM, OWS/PRINTER FURNITURE BOM, CONTROL DESK LAYOUT / GA DRAWING, PLC CATALOGUE, PROCESS GRAPHIC MANUSCRIPTS PLC, PROCESS GRAPHIC MANUSCRIPTS FOR DDCMIS, PANEL HEAT DISSIPATION DATA | 10 | A4/A3/A2 AS APPLICABLE |
| 39. | PE-V2-408-155A-A039  | INSTRUMENT INSTALLATION/ HOOK UP DIAGRAMS  | 12 | A3                     |
| 40. | PE-V2-408-155A-A040  | FIELD JB TERMINATIONS /GROUPING DOCUMENT   | 12 | A3                     |
| 41. | PE-V2-408-155A-A041  | PLC PANEL GA (INTERNAL & EXTERNAL) DRAWING   | 10 | A1                     |
| 42. | PE-V2-408-155A-A042  | CONTROL SCHEMES (BLOCK LOGIC)  | 10 | A1                     |
| 43. | PE-V2-408-155A-A043  | UPS BATTERY CHARGER/ BATTERY DATASHEET & SLD   | 10 | A4                     |
| 44. | PE-V2-408-155A-A044  | UPS SIZING CALCULATIONS  | 10 | A4                     |
| 45. | PE-V2-408-155A-A045  | BATTERY SIZING CALCULATIONS  | 10 | A4                     |
| 46. | PE-V2-408-155A-A046  | LIST OF SIGNAL EXCHANGE WITH DDCMIS (BOTH HARDWIRED & SERIAL INTERFACE IN BHEL FORMAT)   | 12 | A3                     |
| 47. | PE-V2-408-155A-A047  | PANEL & ELECTRONIC EARTHING REQUIREMENT  | 10 | A1                     |
| 48. | PE-V2-408-155A-A048  | PLC EARTHING SCHEME  | 10 | A1                     |



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| 49. | PE-V2-408-155A-A049 | QAP / ICL FOR CPU (FOR BALANCE OF ITEMS)                           | 12 | A4                     |
| 50. | PE-V2-408-155A-A050 | ERECTION PROCEDURE   | 16 | A4                     |
| 51. | PE-V2-408-155A-A051 | YARD PIPING LAYOUT   | 16 | A1                     |
| 52. | PE-V2-408-155A-A052 | CABLE SCHEDULE FOR CONDENSATE POLISHING UNIT                       | 16 | A3                     |
| 53. | PE-V2-408-155A-A053 | PERFORMANCE GUARANTEE TEST PROCEDURE FOR CONDENSATE POLISHING UNIT | 20 | A4                     |
| 54. | PE-V2-408-155A-A054 | ENGINEERING BOQ  | 20 | A4                     |
| 55. | PE-V2-408-155A-A055 | O&M MANUAL FOR CONDENSATE POLISHING UNIT                           | 24 | A4/A3/A2 AS APPLICABLE |

**Note-** The drawing/document marked as ( \* ) shall be considered as basic drawings/documents. In addition to above bidder to refer Section-C3 & C4 for documents related to Electrical & Control & instrumentation respectively.

- (a) Bidder to note that drawings/documents submission shall be through web based Document Management System. Bidder would be provided access to the DMS for drawings/documents approval and adequate training for the same. Detailed methodology would be finalized during the kick-off meeting. Bidder to ensure following at their end.
- Internet explorer version – Minimum Internet Explorer 7
  - Internet speed – 2 mbps (Minimum preferred)
  - Pop ups from our external DMS IP (124.124.36.198) should not be blocked
  - Vendor's internal proxy setting should not block DMS application's link
    - (<http://124.124.36.198/wrenchwebaccess/login.aspx>)
  - DMS user manuals to be used by BHEL PEM vendors for uploading, viewing, revising, commenting and tracking documents on PEM's DMS have been uploaded on PEM internet website ([www.bhelpem.com](http://www.bhelpem.com)) under the Vendor session.
  - For quick access bidder may refer the link <http://bhelpem.com/DMSManuals/DMSManuals.html>



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**ANNEXURE-IX**  
**FORMAT FOR OPERATION AND**  
**MAINTENANCE MANUAL**



**TITLE:**

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## Format for Operation & Maintenance Manual

Project name :

Project number :

Package Name :

PO reference :

Document number :

Revision number :

| Sl.no. & Sections | Description   | Tick ( √ )if included in Manual |    |                | Remarks |
|-------------------|---|---------------------------------|----|----------------|---------|
|                   |   | Yes                             | No | Not Applicable |         |
| <b>1.</b>         | <b>Cover page</b>   |                                 |    |                |         |
| <b>1.1</b>        | Project Name  |                                 |    |                |         |
| <b>1.2</b>        | Customer/consultant Name  |                                 |    |                |         |
| <b>1.3</b>        | Name of Package   |                                 |    |                |         |
| <b>1.4</b>        | Supplier details with phone, FAX ,email address , Emergency Contact number  |                                 |    |                |         |
| <b>1.5</b>        | Name and sign of prepared by , checked by & approved by   |                                 |    |                |         |
| <b>1.6</b>        | Revision history with approval Details  |                                 |    |                |         |
| <b>2.0</b>        | <b>Index</b>  |                                 |    |                |         |
| <b>2.1</b>        | showing the sections & related page nos<br>All the pages should be numbered section wise  |                                 |    |                |         |
| <b>3.0</b>        | <b>Description of Plant/System</b>  |                                 |    |                |         |
| <b>3.1</b>        | Description /write up of operating principle of system equipment/ associated sub-systems & accessories/controls system , operating conditions, performance parameters under normal , start up and special cases |                                 |    |                |         |
| <b>3.2</b>        | Equipment list and basic parameter with Tag numbers   |                                 |    |                |         |
| <b>3.3</b>        | Data sheets approved by Customer/for information and catalogues provided by original manufacturer   |                                 |    |                |         |
| <b>3.4</b>        | Associated other packages and Interface /terminal points  |                                 |    |                |         |
| <b>3.5</b>        | P&ID & Process Diagrams   |                                 |    |                |         |
| <b>3.6</b>        | GA Layout drawings, As-built drawings , Actual photograph of items/system (Drawings of A2 & bigger sizes are to be attached in the last)  |                                 |    |                |         |
| <b>3.7</b>        | Single line/wiring diagrams   |                                 |    |                |         |



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| <b>3.8</b>  | Control philosophy /control write-ups   |  |  |  |  |
| <b>4.0</b>  | Commissioning Activities (if not covered in separate document i.e. erection manual, commissioning manual)   |  |  |  |  |
| <b>4.1</b>  | Pre-Commissioning Checks  |  |  |  |  |
| <b>4.2</b>  | handling of items at site   |  |  |  |  |
| <b>4.3</b>  | Storage at site   |  |  |  |  |
| <b>4.4</b>  | Unpacking & Installation procedure  |  |  |  |  |
| <b>5.0</b>  | Operation Guidelines for plant personal/user/operator   |  |  |  |  |
| <b>5.1</b>  | Interlock & Protection logic along with the limiting values of protection settings for the equipment along with brief philosophy behind the logic, drawings etc. to be provided.  |  |  |  |  |
| <b>5.2</b>  | Start up, normal operation and shut down procedure for equipments along with the associated systems in step by step mode. Valve sequence chart, step list, interlocks etc. with Equipment isolating procedures to be mentioned. |  |  |  |  |
| <b>5.3</b>  | Do's & Don't of the equipments.   |  |  |  |  |
| <b>5.4</b>  | Safety precautions to be taken during normal operation. Safety symbols, Emergency instructions on total power failure condition/lubrication failure/any other condition   |  |  |  |  |
| <b>5.5</b>  | Parameters to be monitored with normal values and limiting values   |  |  |  |  |
| <b>5.6</b>  | Trouble shooting with causes and remedial measures  |  |  |  |  |
| <b>5.7</b>  | Routine operational checks, recommended logs & records  |  |  |  |  |
| <b>5.8</b>  | Changeover schedule if more than one auxiliary for the same purpose is given  |  |  |  |  |
| <b>5.9</b>  | Painting requirement and schedule   |  |  |  |  |
| <b>5.10</b> | Inspection, repair , Testing and calibration procedures   |  |  |  |  |
| <b>6.0</b>  | Maintenance guidelines for plant personal   |  |  |  |  |
| <b>6.1</b>  | List of Special Tools and Tackles required for Overhaul/Trouble shooting including special testing equipment required for calibration etc.  |  |  |  |  |
| <b>6.2</b>  | Stepwise dismantling and re-assembly procedure clearly specifying the tools to be   |  |  |  |  |



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|-------------|--|--|--|--|--|
|             | used, checks to be made, records to be maintained, clearances etc. to be mentioned. Tolerances for fitment of various components to be given.  |  |  |  |  |
| <b>6.3</b>  | Preventive Maintenance & Overhauling schedules linked with running hours/calendar period along with checks to be given   |  |  |  |  |
| <b>6.4</b>  | Long term maintenance schedules especially for structural, foundations etc.  |  |  |  |  |
| <b>6.5</b>  | Consumable list along with the estimated quantity required during commissioning, normal running and during maintenance like Preventive Maintenances and Overhaul. Storage/handling requirement of consumables/self-life. |  |  |  |  |
| <b>6.6</b>  | List of lubricants with their Indian equivalent, Lubrication Schedule, Quantity required for each equipment for complete replacement is to be given  |  |  |  |  |
| <b>6.7</b>  | List of vendors & Sub-vendors with their latest addresses, service centres ,Telephone Nos., Fax Nos., Mobile Nos., e-mail IDs etc.   |  |  |  |  |
| <b>6.8</b>  | List of mandatory and recommended spare parts list   |  |  |  |  |
| <b>6.9</b>  | Tentative Lead time required for ordering of spares from the equipment supplier  |  |  |  |  |
| <b>6.10</b> | Guarantee and warranty clauses   |  |  |  |  |
| <b>7.0</b>  | <b>Statutory and other specific requirements considerations.</b>   |  |  |  |  |
| <b>8.0</b>  | <b>List of reference documents</b>   |  |  |  |  |
| <b>9.0</b>  | <b>Binding as per requirement</b>  |  |  |  |  |



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## VOLUME-III



1X800 MW WANAKBORI STPP  
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LIST OF DOCUMENTS TO BE  
SUBMITTED WITH BID

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SHEET 1 OF 1

DOCUMENTS TO BE SUBMITTED BY BIDDER ALONG WITH THE BID.

**BIDDER SHOULD SUBMIT THE SIGNED AND STAMPED COPY OF THE FOLLOWING DOCUMENTS (FOR ELECTRICAL AND C&I PLEASE REFER THE RESPECTIVE SECTION OF THE SPECIFICATION):**

1. Deviation if any strictly in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed)
2. Compliance certificate.(Stamped & Signed)
3. Un Price Schedule duly filled in. (Stamped & Signed)
4. Un priced format for mandatory spare. (Stamped & Signed)
5. List of Startup & commissioning spares if any. (Stamped & Signed)
6. List of Recommended spares if any. (Stamped & Signed)
7. Complete set of technical specification. (Stamped & Signed)
8. Layout of Condensate polishing unit Service vessel area. (Stamped & Signed)
9. Layout of Condensate polishing unit Regeneration area. (Stamped & Signed)
10. Following guaranteed chemical consumption required per regeneration per vessel (in kg). (Stamped & Signed)
11. Acid (30% HCL) consumption per vessel per regeneration.
12. Alkali (48 % NaOH) consumption per vessel per regeneration.

Note: Any other documents submitted by bidder except as asked in the bid's specification shall not be evaluated & considered as **null & void**.



TITLE:

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COMPLIANCE CUM CONFIRMATION  
CERTIFICATE**

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SHEET 1 OF 2

**COMPLIANCE CUM CONFIRMATION CERTIFICATE**

The bidder shall confirm compliance with following by signing / stamping this compliance certificate (every sheet) and furnish same with the offer.

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions, other than those mentioned under "exclusion and those resolved as per 'Schedule of Deviations', with regard to same.
- b) There are no other deviations w.r.t. specifications other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL / CUSTOMER approval & customer hold points for inspection / testing shall be marked in the QP at the contract stage. Inspection / testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. This is within the contracted price without any extra implications to BHEL after award of the contract.
- d) All drawings/ data-sheets / calculations etc. submitted along with the offer shall not be taken cognizance off.
- e) The offered materials shall be either equivalent or superior to those specified in the specification & shall meet the specified / intended duty requirements. In case the material specified in the specifications is not compatible for intended duty requirements then same shall be resolved by the bidder with BHEL during the pre-bid discussions, otherwise BHEL / Customer's decision shall be binding on the bidder whenever the deficiency is pointed out.

For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.

- f) The commissioning spares shall be supplied on 'As Required Basis' & prices for same included in the base price itself.
- g) All sub vendors shall be subject to BHEL / CUSTOMER approval in the event of order.
- h) Guarantee for plant/equipment shall be as per relevant clause of GCC / SCC / Other Commercial Terms & Conditions
- i) In the event of order, all the material required for completing the job at site shall be supplied by the bidder within the ordered price even if the same are additional to approved billing break up, approved drawing or approved Bill of quantities within the scope of work as tender specification. This clause will apply in case during site



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commissioning, additional requirements emerges due to customer and / or consultant's comments. No extra claims shall be put on this account

- j) Schedule of drawings submissions, comment incorporations & approval shall be as stipulated in the specifications. The successful bidder shall depute his design personnel to BHEL's / Customer's / Consultant's office for across the table resolution of issues and to get documents approved in the stipulated time.
- k) As built drawings shall be submitted as and when required during the project execution.
- l) The bidder has not tempered with this compliance cum confirmation certificate and if at any stage any tempering in the signed copy of this document is noticed then same shall be treated as breach of contract and suitable actions shall be taken against the bidder.
- m) Successful bidder shall furnish detailed erection manual for each of the equipment supplied under this contract at least 3 months before the scheduled erection of the concerned equipment / component or along with supply of concerned equipment / component whichever is earlier.
- n) Document approval by customer under Approval category or information category shall not absolve the vendor of their contractual obligations of completing the work as per specification requirement. Any deviation from specified requirement shall be reported by the vendor in writing and require written approval. Unless any change in specified requirement has been brought out by the vendor during detail engineering in writing while submitting the document to customer for approval, approved document (with implicit deviation) will not be cited as a reason for not following the specification requirement.
- o) In case vendor submits revised drawing after approval of the corresponding drawing, any delay in approval of revised drawing shall be to vendor's account and shall not be used as a reason for extension in contract completion.



3. All the bidders have to list out all their Technical & Commercial Deviations (if any) in detail in the above format.

4. Any deviation not mentioned above and shown separately or found hidden in offer, will not be taken cognizance of

5. Bidder shall submit duly filled unpriced copy of above format indicating "quoted" in "cost of withdrawal of deviation" column of the schedule above along with their Techno-commercial offer, wherever applicable.

6. Bidder shall furnish price copy of above format along with price bid.

7. The final decision of acceptance/ rejection of the deviations quoted by the bidder shall be at discretion of the Purchaser.

8. Bidders to note that any deviation (technical/commercial) not listed in above and asked after Part-I opening shall not be considered.

9. For deviations w.r.t. Payment terms, Liquidated damages, Firm prices and submission of E1/ E2 forms before claiming 10% payment, if a bidder chooses not to give any cost of withdrawal of deviation loading as per Annexure-VIII of GCC, Rev-06 will apply. For any other deviation mentioned in un-priced copy of this format submitted with Part-I bid but not mentioned in priced copy of this format submitted with Priced bid, the cost of withdrawal of deviation shall be taken as NIL.

10. Any deviation mentioned in priced copy of this format, but not mentioned in the un-priced copy, shall not be accepted.

11. All techno-commercial terms and conditions of NIT shall be deemed to have been accepted by the bidder, other than those listed in unpriced copy of this format.

12. Cost of withdrawal is to be given separately for each deviation. In no event bidder should club cost of withdrawal of more than one deviation else cost of withdrawal of such deviations which have been clubbed together shall be considered as NIL.

13. In case nature of cost of withdrawal (positive/negative) is not specified it shall be assumed as positive.

14. In case of discrepancy in the nature of impact (positive/ negative), positive will be considered for evaluation and negative for ordering.



1X800 MW WANAKBORI STPP  
TECHNICAL SPECIFICATION FOR  
CONDENSATE POLISHING UNIT  
PRE-BID CLARIFICATION SCHEDULE

SPECIFICATION NO.: PE-TS-408-155-A001  
VOLUME III  
SECTION  
REV 00  
SHEET 1 OF 1

**PRE-BID CLARIFICATION SCHEDULE**

| S. NO. | SECTION/CLAUSE/PAGE NO. | STATEMENT OF THE REFERRED CLAUSE | CLARIFICATION REQUIRED |
|--------|-------------------------|----------------------------------|------------------------|
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|        |                         |                                  |                        |

The bidder hereby clarifies that above mentioned are the only clarifications required on the technical specification for the subject package.

Signature: \_\_\_\_\_

Name: \_\_\_\_\_

Designation: \_\_\_\_\_

Company: \_\_\_\_\_

Date: \_\_\_\_\_

Company Seal



| ANNEXURE -A   |   |                  |                          |                     |
|---|---|------------------|--------------------------|---------------------|
| 1.00  | Total lump sum firm price on FOR site basis for design, engineering, manufacture, fabrication, assembly, inspection & testing at vendor's & sub-vendor's works, painting, forwarding, supply and delivery at site including start up and commissioning spares, mandatory spares, properly packed for transportation, unloading / handling and storage at site, in site transportation, assembly, erection and commissioning, trial run, preparation and submission of "As Built" drawings, site testing, carrying out performance guarantee tests at site and handover of Condensate Polishing Unit and external regeneration system as per the details in different sections / volumes of BHEL Technical specification (PE-TS-408-155-A001) for <b>1X800 MW WANAKBORI STPP</b> . |                  |                          |                     |
| a)  | Bidder to note that total price indicated above at 1 shall be considered for evaluation and hence should be complete in all respect for the full scope defined and considering all terms and conditions agreed.   |                  |                          |                     |
| b)  | In case, price indicated above does not match with item wise break-up given at 2, the highest price so calculated shall be considered for evaluation but in case of order, the same shall be placed at the lowest price.  |                  |                          |                     |
| 2.00  | <b>MAJOR BREAK-UP OF PRICES GIVEN IN 1 ABOVE</b>  |                  |                          |                     |
| 2.01  | Total lumpsum firm price for <b>EQUIPMENT (SUPPLY, DESIGN &amp; ENGINEERING)</b> i.e.manufacture, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, mandatory spares alongwith spares for erection, startup and commissioning as required, forwarding, proper packing, shipment and delivery at site, inclusive of all taxes & duties for the complete scope of supply of <b>CONDENSATE POLISHING UNIT</b> and external regeneration system to the end customer complete with all accessories for the total scope defined as per tender technical specification ( <b>PE-TS-408-155-A001</b> ).  |                  |                          |                     |
| 2.02  | Total lump sum firm price for all services including unloading, handling, transportation & storage at site , in site transportation, assembly, erection & commissioning, trial run on FOR site basis preparation and submission of "As Built" drawings, etc, required for completion of <b>CONDENSATE POLISHING UNIT</b> as per tender technical specification ( <b>PE-TS-408-155-A001</b> ).   |                  |                          |                     |
| 2.03  | Price for performance guarantee test and handing over the plant to the customer.  |                  |                          |                     |
| 2.04  | Price for Mandatory spares (as per list indicated in Mandatory spares list (Annexure - II) of Specification).   |                  |                          |                     |
| 2.05  | Recommended spares (optional item).   |                  |                          |                     |
| <b>APPENDIX-A-PERCENTAGE BREAKUP FOR CONDENSATE POLISHING UNIT</b>      |   |                  |                          |                     |
| 1.00  | Break-up (%) of prices given at Sl No-2.01 above (To be used during contract execution for payment).  |                  |                          |                     |
| 1.01  | Lumpsum firm price for supply of Service vessels inclusive of all taxes, duties and other levies as applicable.   |                  | 15% of sl no 2.01 above. |                     |
| 1.02  | Lumpsum firm price for supply of Pressure vessels other than Service vessels inclusive of all taxes, duties and other levies as applicable.   |                  | 10% of sl no 2.01 above. |                     |
| 1.03  | Lumpsum firm price for supply of Resin inclusive of all taxes, duties and other levies as applicable.   |                  | 12% of sl no 2.01 above. |                     |
| 1.04  | Lumpsum firm price for supply of Atmospheric tank inclusive of all taxes, duties and other levies as applicable.  |                  | 6% of sl no 2.01 above.  |                     |
| 1.05  | Lumpsum firm price for supply of Low Pressure Valves inclusive of all taxes, duties and other levies as applicable.   |                  | 7% of sl no 2.01 above.  |                     |
| 1.06  | Lumpsum firm price for supply of High Pressure Valves inclusive of all taxes, duties and other levies as applicable.  |                  | 10% of sl no 2.01 above. |                     |
| 1.07  | Lumpsum firm price for supply of Instruments & Analyser inclusive of all taxes, duties and other levies as applicable.  |                  | 8% of sl no 2.01 above.  |                     |
| 1.08  | Lumpsum firm price for supply of Rotary Equipments (Pumps,Blowers,Agitators etc.) inclusive of all taxes, duties and other levies as applicable.  |                  | 5% of sl no 2.01 above.  |                     |
| 1.09  | Lumpsum firm price for supply of Piping & Fittings inclusive of all taxes, duties and other levies as applicable.   |                  | 10% of sl no 2.01 above. |                     |
| 1.10  | Lumpsum firm price for supply of PLC,UPS, batteries etc. inclusive of all taxes, duties and other levies as applicable.   |                  | 10% of sl no 2.01 above. |                     |
| 1.11  | Lumpsum firm price for supply of Balance items inclusive of all taxes, duties and other levies as applicable.   |                  | 7% of sl no 2.01 above.  |                     |
| <b>Bidder shall furnish this price schedule in his price offer only</b> |   |                  |                          |                     |
| <b>Particulars of bidder / authorised representative</b>                |   |                  |                          |                     |
| <b>Name</b>   | <b>Designation</b>  | <b>Signature</b> | <b>Date</b>              | <b>Company seal</b> |

| ANNEXURE-B  |              |      |                   |
|---|--------------|------|-------------------|
| LIST OF CIF CONTENTS FOR CONDENSATE POLISHING UNIT FOR<br>1X800 MW WANAKBORI STPP |              |      |                   |
| S.NO.   | DESCRIPTIONS | UNIT | TOTAL CIF CONTENT |
| 1)  | Resins       |      |                   |
|   |              |      |                   |
|   |              |      |                   |
|   |              |      |                   |
|   |              |      |                   |



**TITLE:**  
**1X800 MW WANAKBORI STPP**  
**TECHNICAL SPECIFICATION FOR**  
**CONDENSATE POLISHING UNIT**

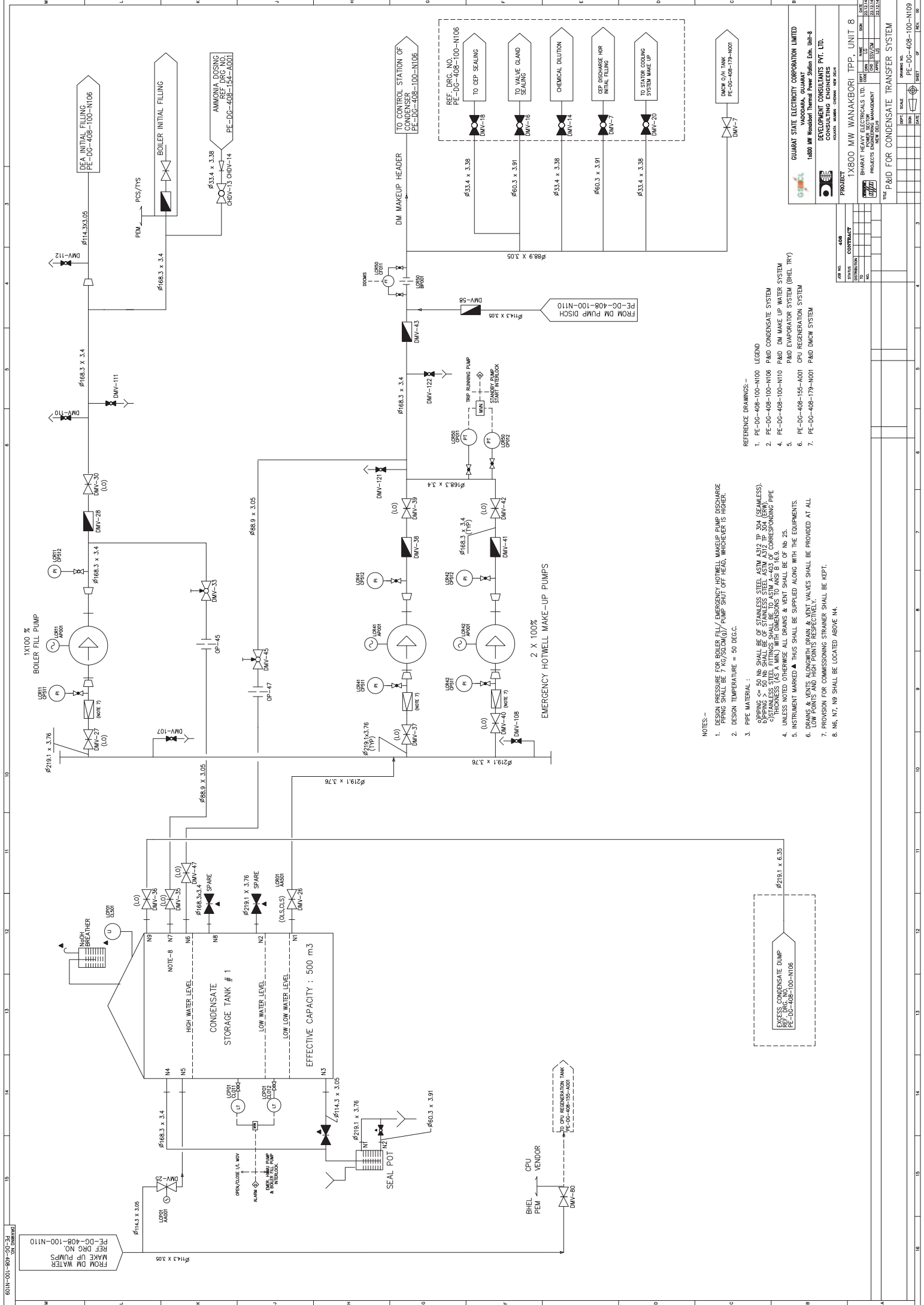
SPECIFICATION NO.: PE-TS-408-155-A001

VOLUME III

SECTION

REV. NO. 00

## DRAWINGS



- NOTES -
- DESIGN PRESSURE FOR BOILER FILL/ EMERGENCY HOTWELL MAKEUP PUMP DISCHARGE PIPING SHALL BE 7 KG/50CM(G)/ PUMP SHUT OFF HEAD, WHICHEVER IS HIGHER.
  - DESIGN TEMPERATURE = 50 DEGC.
  - PIPE MATERIAL :
    - OPING > 50 MM SHALL BE OF STAINLESS STEEL ASTM A312 TP 304 (SEAMLESS).
    - OPING < 50 MM SHALL BE OF STAINLESS STEEL ASTM A312 TP 304 (ERW).
    - STAINLESS STEEL FITTINGS SHALL BE TO ASTM A-403 OF CORRESPONDING PIPE.
    - UNLESS NOTED OTHERWISE ALL BRANS & VENT SHALL BE OF NB 25.
  - INSTRUMENT MARKED ▲ THIS SHALL BE SUPPLIED ALONG WITH THE EQUIPMENTS.
  - BRANS & VENTS ALONG WITH BRANS & VENT VALVES SHALL BE PROVIDED AT ALL POINTS INDICATED BY THE INSTRUMENTATION.
  - PROVISION FOR COMMISSIONING STRAINER SHALL BE KEPT.
  - MB, N7, N9 SHALL BE LOCATED ABOVE MH.
- REFERENCE DRAWINGS -
- PE-DC-408-100-N100 LEGEND
  - PE-DC-408-100-N106 P&ID CONDENSATE SYSTEM
  - PE-DC-408-100-N110 P&ID DM MAKE UP WATER SYSTEM
  - PE-DC-408-100-N110 P&ID EVAPORATOR SYSTEM (BHEL TRY)
  - PE-DC-408-154-A001 CPU REGENERATION SYSTEM
  - PE-DC-408-179-N001 CPU REGENERATION SYSTEM
  - PE-DC-408-179-N001 P&ID DMCW SYSTEM

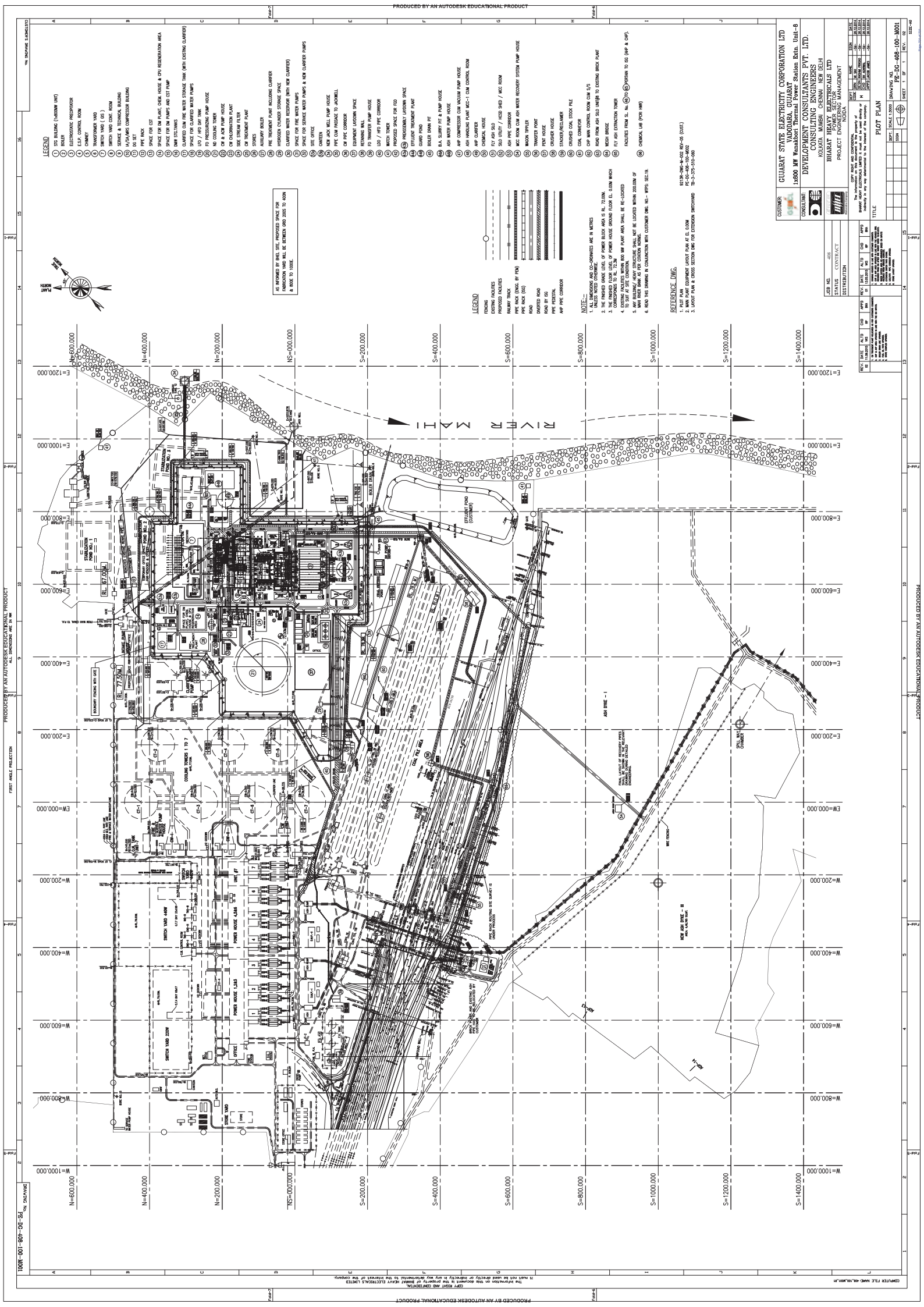
EXCESS CONDENSATE DUMP  
PE-DC-408-100-N106

GUJARAT STATE ELECTRICITY CORPORATION LIMITED  
VAODARA, GUJARAT  
1480 MW Wambud Thermal Power Station Ecm. Unit-8  
DEVELOPMENT CONSULTANTS PVT. LTD.  
CONSULTING ENGINEERS  
VAODARA, GUJARAT, INDIA

PROJECT: 1X800 MW WANKBORI TPP UNIT 8  
CONTRACT: BHARAT HEAVY ELECTRICALS LTD. (BHEL) POWER SUPPLY SYSTEM FOR WANKBORI THERMAL POWER STATION UNIT 8  
SHEET NO. 22/31/1  
DATE: 22/03/16

THE P&ID FOR CONDENSATE TRANSFER SYSTEM

SCALE: 1:1  
DATE: 22/03/16



1000-001-801-30-01 ON DRAWING

PRODUCED BY AN AUTODESK EDUCATIONAL PRODUCT

FIRST ANGLE PROJECTION

NO. DRAWING SUBMITTED

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LEGEND

1. STEEL BEAMS (HIDDEN UNIT)

2. BOILER

3. ELECTROSTATIC PRECIPITATOR

4. E.S.P. CONTROL ROOM

5. CHIMNEY

6. TRANSFORMER VAULT

7. 11KV BUS BAR

8. 11KV BUS BAR ROOM

9. SERVICE & TECHNICAL BUILDING

10. 11KV/22KV COMPRESSOR BUILDING

11. D.C. SET

12. PIPE RACK

13. SPACE FOR C&I

14. SPACE FOR PLANT, CHEM. HOUSE & CPU IDENTIFICATION AREA

15. SPACE FOR ON PUMPS AND C&I TANK

16. CLARIFIED WATER STORAGE TANK (WITH EXISTING CLARIFIER)

17. SPACE FOR CLARIFIED WATER PUMPS

18. 11KV / 11KV BUS BAR

19. 11KV / 11KV BUS BAR

20. NO. COUPLER

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