

**TELANGANA STATE POWER GENERATION  
CORPORATION LIMITED (TSGENCO)**

**5X800 MW YADADRI THERMAL POWER STATION**

**TECHNICAL SPECIFICATION  
FOR  
CONDENSATE POLISHING UNIT**

**SPECIFICATION NO.: PE-TS-417-155A-A001**



**BHARAT HEAVY ELECTRICALS LIMITED  
POWER SECTOR  
PROJECT ENGINEERING MANAGEMENT  
NOIDA**



|                                                                    |                                       |                   |
|--------------------------------------------------------------------|---------------------------------------|-------------------|
| <b>TITLE:</b><br><b>5X800 MW YADADRI THERMAL<br/>POWER STATION</b> | SPECIFICATION NO. PE-TS-417-155A-A001 |                   |
|                                                                    | REV. NO. 00                           | DATE : 20/01/2019 |

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**TITLE :**  
**5X800 MW YADADRI THERMAL POWER  
STATION**

**SPECIFICATION NO. PE-TS-417-155A-  
A001**

**SECTION :**

**TECHNICAL SPECIFICATION FOR  
CONDENSATE POLISHING UNIT**

**SUB-SECTION:**

**REV. NO. 00**

**DATE :**

## PROJECT INFORMATION

**YADADRI THERMAL POWER STATION****PROJECT INFORMATION**

|    |                                           |                                                                         |
|----|-------------------------------------------|-------------------------------------------------------------------------|
| 1  | Name of the Project                       | YADADRI Thermal Power Station                                           |
| 2  | Station Capacity                          | 5X800 MW ( Coal based )                                                 |
| 3  | Owner                                     | Telangana State Power Generation Corporation Limited ( <b>TSGENCO</b> ) |
| 4  | Site Location                             | Site is located 7 km from the NH5.                                      |
| 5  | Latitude                                  | 16° 42'20.40 N                                                          |
| 6  | Longitude                                 | 79° 34'41.56 E                                                          |
| 7  | Nearest Town                              | 30 Km Miryalaguda                                                       |
| 8  | Nearest Railway Station                   | 6.5 Km Damercherla                                                      |
| 9  | Nearest Airport                           | 130 Kms (Vijayawada)                                                    |
| 10 | <b>Site Conditions</b>                    |                                                                         |
|    | Ambient Temperature                       |                                                                         |
|    | Daily minimum ( average)                  | 10°C                                                                    |
|    | Daily maximum ( average)                  | 47°C                                                                    |
|    | Design Ambient Temperature                | 50°C                                                                    |
|    | Ambient temperature ( performance)        | 38°C                                                                    |
|    | Relative Humidity for design / efficiency | 48-84 %                                                                 |
|    | Annual rainfall, mm                       | 600 mm                                                                  |
|    | Plant Elevation above MSL                 | 85 m above MSL                                                          |

TELANGANA STATE POWER GENERATION CORPORATION LIMITED

From  
Chief Engineer/Civil/ Thermal  
TSGENCO, Vidyut Soudha,  
Hyderabad – 500082

To  
✓ The Dy.General Manager,  
M/s.BHEL Camp Office,  
Vidyut Soudha,  
Khairtabad,  
Hyderabad – 500082

Lr.No.CE/C/Thermal/KTPSD/E1/F.YTPS-M/s.BHEL/D.No. 247 /2015-16,Dt. 29.08.2015

Sir,

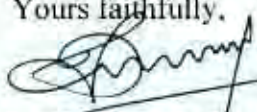
Sub:- YTPS – 5x800MW- Wind load & Seismic zone details - Reg

Ref: email; dated.11.08.2015 from M/s.BHEL.

With reference to the email cited,the details of wind load & seismic zone pertaining to proposed Yadradri Thermal Power Station (5x800MW) are herewith furnished for taking further action.

| Wind load  |                  | Seismic zone                 |                                                                                                  |
|------------|------------------|------------------------------|--------------------------------------------------------------------------------------------------|
| Wind Speed | Terrain category | Seismic zone                 | Type of soil                                                                                     |
| 44m/Sec    | Category-2       | Zone-III as per IS 1893:2002 | Type of soil may be confirmed at your end after conducting soil investigation in the plant area. |

Yours faithfully,

  
19/8/2015  
CHIEF ENGINEER/CIVIL/THERMAL

Copy to the:

Chief Engineer/TPC/TSGENCO/Vidyut Soudha/Hyderabad.

A.S to Director/Projects/ TSGENCO/Vidyut Soudha/Hyderabad

M/s.DESEIN Private Limited, 102, First floor, My Home Sarovar Plaza, Secretariat Road, Hyderabad-500063.

## जलवायवी सारणी

## CLIMATOLOGICAL TABLE

BACK

स्टेशन : नलगोंदा  
STATION : Nalgondaअक्षांश  
LAT. 17° 03'देशांतर  
LONG. 79° 16'समुद्री तल माध्य से ऊंचाई  
HEIGHT ABOVE M.S.L.मीटर  
227 METRESप्रक्षेपों पर आधारित  
BASED ON OBSERVATIONS 1975-2000

| माह                                       |      | स्टेशन का सतह दाब      | वायु तापमान     |           |              |               |                      |                     |           |                |           |                | आर्द्रता          |                 | मेघ की मात्रा               |            | BASED ON OBSERVATIONS 1975-2000 |                   |                                  |                                 |                           |                          |                               |                               |                             |                |               |
|-------------------------------------------|------|------------------------|-----------------|-----------|--------------|---------------|----------------------|---------------------|-----------|----------------|-----------|----------------|-------------------|-----------------|-----------------------------|------------|---------------------------------|-------------------|----------------------------------|---------------------------------|---------------------------|--------------------------|-------------------------------|-------------------------------|-----------------------------|----------------|---------------|
|                                           |      |                        | माध्य           |           |              |               |                      |                     | चरम       |                |           |                |                   |                 |                             |            | वर्षा                           |                   |                                  |                                 |                           |                          |                               |                               |                             |                |               |
|                                           |      |                        | शुष्क बल्ब      | नम बल्ब   | दैनिक अधिकतम | दैनिक न्यूनतम | माह में उच्चतम       | माह में निम्नतम     | उच्चतम    | दिनांक और वर्ष | निम्नतम   | दिनांक और वर्ष |                   |                 |                             |            | सापेक्ष आर्द्रता                | वाष्प दाब         | समस्त मेघ                        | निम्न मेघ                       | मासिक योग                 | वर्षा के दिनों की संख्या | वर्षसहित सबसे नम महीने का योग | वर्षसहित शुष्कतम महीने का योग | 24 घंटों की सबसे भारी वर्षा | दिनांक और वर्ष | माध्य पवन गति |
|                                           |      |                        |                 |           |              |               |                      |                     |           |                |           |                |                   |                 |                             |            |                                 |                   |                                  |                                 |                           |                          |                               |                               |                             |                |               |
| MONTH                                     |      | STATION LEVEL PRESSURE | AIR TEMPERATURE |           |              |               |                      |                     | EXTREMES  |                |           |                | HUMIDITY          |                 | CLOUD AMOUNTS               |            | RAINFALL                        |                   |                                  |                                 |                           |                          |                               |                               |                             |                |               |
|                                           |      |                        | DRY BULB        | WET BULB  | DAILY MAX    | DAILY MIN     | HIGHEST IN THE MONTH | LOWEST IN THE MONTH | HIGHEST   | DATE AND YEAR  | LOWEST    | DATE AND YEAR  | RELATIVE HUMIDITY | VAPOUR PRESSURE | ALL CLOUDS                  | LOW CLOUDS | MONTHLY TOTAL                   | NO. OF RAINY DAYS | TOTAL IN WETTEST MONTH WITH YEAR | TOTAL IN DRIEST MONTH WITH YEAR | HEAVIEST FALL IN 24 HOURS | DATE AND YEAR            | MEAN WIND SPEED               |                               |                             |                |               |
|                                           |      | एच.पी.ए. hPa           | डि. से °C       | डि. से °C | डि. से °C    | डि. से °C     | डि. से °C            | डि. से °C           | डि. से °C | डि. से °C      | डि. से °C | डि. से °C      | प्रतिशत %         | एच.पी.ए. hPa    | आकाश के अछमारा Oktas of sky |            | मि.मि. mm                       |                   | मि.मि. mm                        | मि.मि. mm                       | मि.मि. mm                 |                          | कि.मी. प्र. घं. Km/h          |                               |                             |                |               |
| जनवरी JAN                                 | I II | 989.9                  | 21.3            | 19.3      | 30.8         | 18.4          | 33.8                 | 16.1                | 36.0      | 17 1998        | 14.4      | 7 1992         | 82                | 21.2            | 2.0                         | 1.8        | 13.5                            | 0.4               | 155.7 1978                       | 0.0                             | 55.4                      | 11 1978                  |                               |                               |                             |                |               |
| फरवरी FEB                                 | I II | 988.0                  | 23.6            | 21.5      | 33.5         | 20.7          | 36.5                 | 18.0                | 39.0      | 26 1980        | 15.4      | 5 1988         | 82                | 24.1            | 3.0                         | 2.5        | 7.2                             | 0.5               | 14.0 1999                        | 0.0                             | 49.2                      | 20 2000                  |                               |                               |                             |                |               |
| मार्च MAR                                 | I II | 985.8                  | 26.2            | 23.7      | 37.3         | 22.8          | 40.9                 | 19.9                | 42.0      | 14 1983        |           |                | 80                | 27.4            | 1.7                         | 1.4        | 6.5                             | 0.4               | 88.5 1981                        | 0.0                             | 43.6                      | 13 1981                  |                               |                               |                             |                |               |
| अप्रैल APR                                | I II | 983.6                  | 29.2            | 25.5      | 39.6         | 25.5          | 43.0                 | 22.4                | 44.5      | 30 1991        | 14.6      | 15 1987        | 73                | 29.7            | 2.1                         | 2.0        | 17.6                            | 1.0               | 65.6 1981                        | 0.0                             | 40.6                      | 24 1981                  |                               |                               |                             |                |               |
| मई MAY                                    | I II | 980.8                  | 31.9            | 26.3      | 41.2         | 28.2          | 44.8                 | 23.5                | 46.1      | 26 1984        |           |                | 63                | 29.7            | 2.7                         | 2.5        | 27.0                            | 1.4               | 94.3 1991                        | 0.0                             | 49.0                      | 5 1981                   |                               |                               |                             |                |               |
| जून JUN                                   | I II | 978.2                  | 29.8            | 25.7      | 37.6         | 27.2          | 42.6                 | 23.4                | 46.3      | 2 1998         | 21.8      | 12 1991        | 71                | 29.9            | 5.1                         | 4.4        | 65.9                            | 3.5               | 48.2 2000                        | 0.0                             | 81.7                      | 12 1991                  |                               |                               |                             |                |               |
| जुलाई JUL                                 | I II | 978.8                  | 27.7            | 24.7      | 33.9         | 25.5          | 37.3                 | 23.2                | 39.2      | 7 1992         | 22.0      | 2 1992         | 77                | 28.6            | 6.3                         | 5.8        | 124.6                           | 6.0               | 176.7 1977                       | 36.8 1979                       | 99.2                      | 24 1977                  |                               |                               |                             |                |               |
| अगस्त AUG                                 | I II | 979.6                  | 27.1            | 24.3      | 32.8         | 25.0          | 35.4                 | 22.8                | 37.5      | 25 1979        | 22.0      | 2 1981         | 78                | 28.2            | 6.1                         | 6.0        | 133.0                           | 6.7               | 189.0 1998                       | 33.2 1979                       | 88.2                      | 14 1977                  |                               |                               |                             |                |               |
| सितम्बर SEP                               | I II | 982.0                  | 27.4            | 24.4      | 33.6         | 24.9          | 36.4                 | 22.8                | 38.5      | 23 1987        | 21.6      | 8 1989         | 77                | 28.3            | 4.9                         | 4.2        | 145.5                           | 5.8               | 393.1 1991                       | 20.3 1984                       | 152.2                     | 21 1991                  |                               |                               |                             |                |               |
| अक्टूबर OCT                               | I II | 985.3                  | 26.6            | 23.8      | 33.1         | 23.7          | 36.2                 | 21.4                | 36.5      | 1 1987         | 19.2      | 28 1980        | 78                | 27.2            | 4.0                         | 3.7        | 104.3                           | 3.8               | 333.1 1981                       | 4.2 1984                        | 109.2                     | 6 1987                   |                               |                               |                             |                |               |
| नवम्बर NOV                                | I II | 987.9                  | 24.2            | 21.0      | 31.1         | 21.2          | 33.5                 | 17.9                | 35.5      | 7 1996         | 14.6      | 27 1981        | 75                | 22.6            | 3.2                         | 2.6        | 48.1                            | 2.8               | 66.8 1991                        | 1.1 1981                        | 163.5                     | 4 1987                   |                               |                               |                             |                |               |
| दिसम्बर DEC                               | I II | 990.3                  | 21.7            | 18.6      | 30.0         | 18.6          | 32.2                 | 15.7                |           |                | 12.6      | 16 1993        | 73                | 19.4            | 2.7                         | 2.3        | 3.8                             | 0.3               | 3.1 1987                         | 0.0                             | 3.1                       | 10 1987                  |                               |                               |                             |                |               |
| वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN | I II | 983.9                  | 26.7            | 23.4      | 34.8         | 23.7          | 44.3                 | 15.9                | 46.3      | 2              | 12.6      | 16             | 75                | 26.6            | 3.7                         | 3.2        | 696.8                           | 32.5              | 631.7                            | 631.7                           | 163.5                     | 4                        |                               |                               |                             |                |               |
| वर्षों की सं NUMBER OF YEARS              | I II | 19                     | 19              | 19        | 19           | 21            | 22                   |                     | 19        |                | 19        |                | 19                | 19              | 18                          | 17         | 20                              | 20                | 16                               | 16                              | 23                        |                          |                               |                               |                             |                |               |



## CLIMATOLOGICAL TABLE

स्टेशन : नलन्दा

STATION : Malgonda

| मौसम परिघटना                              |                         |      |          |       |              |           | पवन                                                  |       |      |    |                                           |     |    |     |   |    |    |    |      | मेघ                                                  |      |     |     |    |     |      |     |                                                        |    |         |             |            |             |              |                   |  | दृश्यता                      |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
|-------------------------------------------|-------------------------|------|----------|-------|--------------|-----------|------------------------------------------------------|-------|------|----|-------------------------------------------|-----|----|-----|---|----|----|----|------|------------------------------------------------------|------|-----|-----|----|-----|------|-----|--------------------------------------------------------|----|---------|-------------|------------|-------------|--------------|-------------------|--|------------------------------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|-------|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|--|------------|--|--|--|--|
| के साथ दिनों की संख्या                    |                         |      |          |       |              |           | पवन की गती के साथ दिनों की संख्या (कि. मी. प्र. घं.) |       |      |    | पवन की दिशा के दिनों की संख्या का प्रतिशत |     |    |     |   |    |    |    |      | मेघ मात्रा (सभी मेघ) सहित दिनों की संख्या - अष्टमांश |      |     |     |    |     |      |     | निम्न स्तरी मेघ मात्रा सहित दिनों की संख्या - अष्टमांश |    |         |             |            |             |              |                   |  | दृश्यता सहित दिनों की संख्या |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| माह                                       | वर्षा 0.3 मि.मि.या अधिक | ओले  | गर्जन    | कुहरा | धूल भरी आंधी | चंद्र वात | 62 या अधिक                                           | 20-61 | 1-19 | 0  | उ                                         | उपू | पू | दपू | र | दप | प  | उप | शांत | 0                                                    | ले-2 | 3-5 | 6-7 | 8  | 0   | ले-2 | 3-5 | 6-7                                                    | 8  | कुहरा 8 | 1 कि.मी. तक | 1-4 कि.मी. | 4-10 कि.मी. | 10-20 कि.मी. | 20 कि.मी. से अधिक |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| WEATHER PHENOMENA                         |                         |      |          |       |              |           |                                                      |       |      |    |                                           |     |    |     |   |    |    |    |      |                                                      |      |     |     |    |     |      |     |                                                        |    |         |             |            |             |              | WIND              |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  | CLOUD |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | VISIBILITY |  |  |  |  |
| No. OF DAYS WITH                          |                         |      |          |       |              |           | No. OF DAYS WITH WIND SPEED (Km. p. h.)              |       |      |    | PERCENTAGE No. OF DAYS WIND FROM          |     |    |     |   |    |    |    |      | No. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS) OKTAS     |      |     |     |    |     |      |     | No. OF DAYS WITH LOW CLOUD AMOUNT OKTAS                |    |         |             |            |             |              |                   |  | No. OF DAYS WITH VISIBILITY  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| MONTH                                     | PFT 0.3 mm Or more      | HAIL | THUN DER | FOG   | DUST STORM   | SQU ALL   | S2 Or more                                           | 20-61 | 1-19 | 0  | N                                         | NE  | E  | SE  | S | SW | W  | NW | CALM | 0                                                    | T-2  | 3-5 | 6-7 | 8  | 0   | T-2  | 3-5 | 6-7                                                    | 8  | FOG 8   | UP TO 1 Km  | 1-4 Kms    | 4-10 Kms    | 10-20 Kms    | OVER 20 Kms       |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| जनवरी JAN                                 | 0.5                     | 0.0  | 0.0      | 0.0   | 0.0          | 0.0       | 0                                                    | 0     | 29   | 2  | 0                                         | 30  | 3  | 39  | 3 | 4  | 0  | 11 | 10   | 25                                                   | 0    | 2   | 1   | 3  | 25  | 0    | 2   | 1                                                      | 3  | 0       | 0.6         | 6.7        | 21.3        | 2.3          | 0.1               |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| फरवरी FEB                                 | 0.6                     | 0.0  | 0.0      | 0.0   | 0.0          | 0.0       | 0                                                    | 0     | 28   | 0  | 1                                         | 26  | 1  | 55  | 3 | 5  | 0  | 7  | 2    | 18                                                   | 1    | 3   | 2   | 4  | 21  | 1    | 2   | 1                                                      | 3  | 0       | 0.1         | 7.8        | 18.0        | 1.7          | 0.5               |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| मार्च MAR                                 | 0.7                     | 0.0  | 0.1      | 0.0   | 0.0          | 0.0       | 0                                                    | 1     | 30   | 0  | 1                                         | 25  | 1  | 55  | 3 | 5  | 0  | 9  | 1    | 23                                                   | 2    | 3   | 1   | 2  | 25  | 1    | 3   | 1                                                      | 1  | 0       | 0.0         | 3.8        | 24.1        | 2.9          | 0.3               |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| अप्रैल APR                                | 1.1                     | 0.0  | 0.0      | 0.0   | 0.0          | 0.0       | 0                                                    | 0     | 29   | 1  | 0                                         | 20  | 1  | 46  | 4 | 18 | 0  | 8  | 3    | 20                                                   | 2    | 4   | 2   | 2  | 21  | 1    | 4   | 2                                                      | 2  | 0       | 0.0         | 3.0        | 21.5        | 4.3          | 1.1               |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| मई MAY                                    | 1.8                     | 0.0  | 0.0      | 0.0   | 0.0          | 0.0       | 0                                                    | 0     | 31   | 0  | 1                                         | 14  | 0  | 27  | 3 | 21 | 3  | 30 | 1    | 19                                                   | 2    | 5   | 2   | 3  | 21  | 2    | 4   | 1                                                      | 3  | 0       | 0.0         | 3.1        | 22.5        | 3.4          | 1.9               |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| जून JUN                                   | 4.5                     | 0.0  | 0.0      | 0.0   | 0.0          | 0.0       | 0                                                    | 1     | 29   | 0  | 1                                         | 2   | 0  | 6   | 0 | 36 | 8  | 47 | 0    | 5                                                    | 1    | 5   | 4   | 15 | 7   | 1    | 4   | 3                                                      | 15 | 0       | 0.0         | 4.7        | 20.2        | 3.1          | 2.0               |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| जुलाई JUL                                 | 7.1                     | 0.0  | 0.1      | 0.0   | 0.0          | 0.0       | 0                                                    | 1     | 30   | 0  | 1                                         | 1   | 0  | 1   | 0 | 43 | 10 | 44 | 0    | 2                                                    | 1    | 3   | 5   | 20 | 4   | 1    | 2   | 3                                                      | 21 | 0       | 0.0         | 4.3        | 23.1        | 1.9          | 1.6               |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| अगस्त AUG                                 | 7.7                     | 0.0  | 0.0      | 0.0   | 0.0          | 0.0       | 0                                                    | 1     | 30   | 0  | 1                                         | 1   | 0  | 2   | 0 | 32 | 8  | 55 | 1    | 2                                                    | 1    | 5   | 3   | 20 | 3   | 1    | 4   | 2                                                      | 21 | 0       | 0.0         | 4.1        | 22.8        | 2.5          | 1.6               |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| सितम्बर SEP                               | 6.6                     | 0.0  | 0.0      | 0.0   | 0.0          | 0.0       | 0                                                    | 0     | 29   | 1  | 1                                         | 6   | 0  | 11  | 1 | 29 | 4  | 42 | 6    | 4                                                    | 1    | 6   | 4   | 15 | 5   | 1    | 4   | 3                                                      | 17 | 0       | 0.0         | 3.2        | 20.9        | 3.6          | 2.3               |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| अक्टूबर OCT                               | 3.9                     | 0.0  | 0.0      | 0.0   | 0.0          | 0.0       | 0                                                    | 0     | 29   | 2  | 1                                         | 29  | 4  | 16  | 1 | 15 | 2  | 23 | 9    | 18                                                   | 1    | 5   | 2   | 5  | 21  | 0    | 3   | 2                                                      | 5  | 0       | 0.1         | 3.7        | 22.4        | 3.8          | 1.1               |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| नवम्बर NOV                                | 3.3                     | 0.0  | 0.0      | 0.0   | 0.0          | 0.0       | 0                                                    | 0     | 26   | 4  | 3                                         | 33  | 7  | 18  | 2 | 4  | 0  | 19 | 14   | 16                                                   | 1    | 4   | 3   | 6  | 21  | 1    | 2   | 2                                                      | 4  | 0       | 0.0         | 8.8        | 17.8        | 2.9          | 0.4               |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| दिसम्बर DEC                               | 0.4                     | 0.0  | 0.0      | 0.0   | 0.0          | 0.0       | 0                                                    | 0     | 29   | 2  | 3                                         | 46  | 3  | 22  | 1 | 2  | 1  | 14 | 8    | 21                                                   | 1    | 4   | 1   | 4  | 23  | 1    | 3   | 1                                                      | 3  | 0       | 0.1         | 6.8        | 20.8        | 3.3          | 0.0               |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| वार्षिक योग या माध्य ANNUAL TOTAL OR MEAN | 33.3                    | 0.0  | 0.1      | 0.0   | 0.0          | 0.0       | 1                                                    | 5     | 346  | 13 | 1                                         | 19  | 2  | 24  | 2 | 18 | 3  | 26 | 5    | 205                                                  | 13   | 46  | 29  | 70 | 238 | 11   | 37  | 22                                                     | 57 | 0       | 0.8         | 60.1       | 255.4       | 35.6         | 13.0              |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |
| वर्षोंकी सं NUMBER OF YEARS               | 22                      |      |          |       |              |           | 22                                                   |       |      |    | 22                                        |     |    |     |   |    |    |    |      | 21                                                   |      |     |     |    | 21  |      |     |                                                        |    |         | 22          |            |             |              |                   |  |                              |  |  |  |  |  |  |  |  |  |  |  |  |  |  |       |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |            |  |  |  |  |

|                                                                                   |                                          |  |                                   |                 |
|-----------------------------------------------------------------------------------|------------------------------------------|--|-----------------------------------|-----------------|
|  | DOCUMENT TITLE:                          |  | BHEL DOCUMENT NO.: 4-WT-500-01135 |                 |
|                                                                                   | <b>DESIGN MEMORANDUM FOR DM PLANT</b>    |  | DEPARTMENT: WATER BUSINESS GROUP  |                 |
|                                                                                   | <b>5 X 800 MW YADADRI – NALGONDA TPS</b> |  | REV. NO. 02                       | DATE:29.07.2019 |
|                                                                                   |                                          |  | Page: 10 of 69                    |                 |

**Analysis of Raw water****Table-1A**

| S.No. | CONSTITUENTS             | As                      | CONTENT          |
|-------|--------------------------|-------------------------|------------------|
| 1.    | Calcium                  | CaCO <sub>3</sub>       | 94.9 ppm         |
| 2.    | Magnesium                | CaCO <sub>3</sub>       | 74.1 ppm         |
| 3.    | Sodium                   | CaCO <sub>3</sub>       | 184.4 ppm        |
| 4.    | Potassium                | CaCO <sub>3</sub>       | 1.1 ppm          |
| 5.    | Iron in Soln.            | Fe                      | Nil              |
|       | <b>TOTAL CATIONS</b>     | <b>CaCO<sub>3</sub></b> | <b>354.5 ppm</b> |
| 6.    | Bicarbonate              | CaCO <sub>3</sub>       | 150.9 ppm        |
| 7.    | Sulphate                 | CaCO <sub>3</sub>       | 58.3 ppm         |
| 8.    | Chloride                 | CaCO <sub>3</sub>       | 140.5 ppm        |
| 9.    | Nitrate                  | CaCO <sub>3</sub>       | 3.5 ppm          |
| 10.   | Phosphate                | CaCO <sub>3</sub>       | Nil              |
| 11.   | Fluoride                 | CaCO <sub>3</sub>       | 1.3 ppm          |
|       | <b>TOTAL ANIONS</b>      | <b>CaCO<sub>3</sub></b> | <b>354.5 ppm</b> |
| 12.   | Reactive Silica          | SiO <sub>2</sub>        | 14.1 ppm         |
| 13.   | Colloidal Silica         | SiO <sub>2</sub>        | Nil              |
| 14.   | Total Silica             | SiO <sub>2</sub>        | 14.1 ppm         |
| 15.   | Nitrites                 | NO <sub>2</sub>         | Nil              |
| 16.   | Total Hardness           | CaCO <sub>3</sub>       | 169 ppm          |
| 17.   | Temperature              |                         | 25 °C            |
| 18.   | Total Suspended Solid    |                         | 14 ppm           |
| 19.   | Total Dissolved Solids   |                         | 500 ppm          |
| 20.   | Conductivity at 25°C     |                         | 790 µS/cm        |
| 21.   | pH value at 25°C         | -                       | 8.0              |
| 22.   | Turbidity                |                         | 0.9 NTU          |
| 23.   | Colour                   | Pt.Co                   | < 5              |
| 24.   | Residual Cl <sub>2</sub> |                         | 0.0 ppm          |
| 25.   | TOC                      |                         | 9.5 ppm          |
| 26.   | BOD <sub>3</sub> at 27°C |                         | 4 ppm            |
| 27.   | COD                      |                         | 30 ppm           |
| 28.   | Dissolved Oxygen         |                         | 5.8 ppm          |
| 29.   | Oil & Grease             |                         | <1 ppm           |

**Note:**

- 1) Other parameters not indicated in above list has been considered as nil.
- 2) The above raw water analysis is considered based on Water analysis provided by Customer vide meeting dt.05.03.2019



|                                                                                   |                                          |  |                                   |                 |
|-----------------------------------------------------------------------------------|------------------------------------------|--|-----------------------------------|-----------------|
|  | DOCUMENT TITLE:                          |  | BHEL DOCUMENT NO.: 4-WT-500-01135 |                 |
|                                                                                   | <b>DESIGN MEMORANDUM FOR DM PLANT</b>    |  | DEPARTMENT: WATER BUSINESS GROUP  |                 |
|                                                                                   | <b>5 X 800 MW YADADRI – NALGONDA TPS</b> |  | REV. NO. 02                       | DATE:29.07.2019 |
|                                                                                   |                                          |  | Page: 11 of 69                    |                 |

**Analysis of Clarified water****Table-1B**

| S.No. | CONSTITUENTS          | As                      | CONTENT          |
|-------|-----------------------|-------------------------|------------------|
| 1.    | Calcium               | CaCO <sub>3</sub>       | 121.9 ppm        |
| 2.    | Magnesium             | CaCO <sub>3</sub>       | 74.1 ppm         |
| 3.    | Sodium                | CaCO <sub>3</sub>       | 184.4 ppm        |
| 4.    | Potassium             | CaCO <sub>3</sub>       | 1.1 ppm          |
| 5.    | Iron in Soln.         | Fe                      | Nil              |
|       |                       |                         |                  |
|       | <b>TOTAL CATIONS</b>  | <b>CaCO<sub>3</sub></b> | <b>381.5 ppm</b> |
|       |                       |                         |                  |
| 6.    | Bicarbonate           | CaCO <sub>3</sub>       | 134.8 ppm        |
| 7.    | Sulphate              | CaCO <sub>3</sub>       | 80.9 ppm         |
| 8.    | Chloride              | CaCO <sub>3</sub>       | 161.0 ppm        |
| 9.    | Nitrate               | CaCO <sub>3</sub>       | 3.5 ppm          |
| 10.   | Phosphate             | CaCO <sub>3</sub>       | Nil              |
| 11.   | Fluoride              | CaCO <sub>3</sub>       | 1.3 ppm          |
|       |                       |                         |                  |
|       | <b>TOTAL ANIONS</b>   | <b>CaCO<sub>3</sub></b> | <b>381.5 ppm</b> |
|       |                       |                         |                  |
| 12.   | Reactive Silica       | SiO <sub>2</sub>        | 14.1 ppm         |
| 13.   | Colloidal Silica      | SiO <sub>2</sub>        | Nil              |
| 14.   | Total Silica          | SiO <sub>2</sub>        | 14.1 ppm         |
| 15.   | Nitrites              | NO <sub>2</sub>         | Nil              |
| 16.   | Total Hardness        | CaCO <sub>3</sub>       | 196 ppm          |
| 17.   | Total Suspended Solid |                         | 15 ppm           |
| 18.   | pH value at 25°C      | -                       | 8.0              |
| 19.   | Turbidity             |                         | 15 NTU           |

**Note:**

- 3) For the purpose of Design inlet analysis to DM plant, the following have been considered on the Raw water analysis and above clarified water analysis has been arrived.
  - i) Chlorine dosing rate of 5ppm in PT plant
  - ii) Alum dosing rate of 50ppm in PT plant
  - iii) Lime dosing rate of 20ppm in PT plant
  - iv) Poly electrolyte (PE) dosing rate of 1ppm in PT plant
- 4) Other parameters not indicated in above list has been considered as nil.



|                                                                |                                       |        |
|----------------------------------------------------------------|---------------------------------------|--------|
| <b>TITLE:</b><br><b>5X800 MW YADADRI THERMAL POWER STATION</b> | SPECIFICATION NO. PE-TS-417-155A-A001 |        |
|                                                                | SECTION : I                           |        |
|                                                                | <b>SUB-SECTION:</b>                   |        |
|                                                                | <b>REV. NO. 00</b>                    | DATE : |

**SECTION – I**  
**SPECIFIC TECHNICAL REQUIREMENTS**  
**SUB-SECTION IA - Specific Technical Requirements (Mech.)**  
**SUB-SECTION IB - Specific Technical Requirements (Electrical)**  
**SUB-SECTION IC - Specific Technical Requirements (C & I)**



**TITLE:**  
**5X800 MW YADADRI THERMAL POWER  
 STATION**

**SPECIFICATION NO. PE-TS-417-155A-A001**

**SECTION : I**

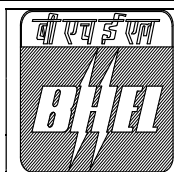
**TECHNICAL SPECIFICATION FOR  
 CONDENSATE POLISHING UNIT**

**SUB-SECTION: IA**

**REV. NO. 00**

**DATE :**

**SECTION – I**  
**SUB-SECTION – IA-SPECIFIC TECHNICAL REQUIREMENTS (MECHANICAL)**



**TITLE:**  
**5X800 MW YADADRI THERMAL POWER STATION**

SPECIFICATION NO. PE-TS-417-155A-A001

SECTION : I

**TECHNICAL SPECIFICATION FOR CONDENSATE POLISHING UNIT**

**SUB-SECTION: IA**

**REV. NO. 00**

**DATE :**

## 1.0 GENERAL

This specification is intended to cover design, engineering, manufacture, supply, fabrication, assembly, inspection / testing at vendor's & sub-vendor's works, painting, maintenance / special tools & tackles, mandatory spares alongwith spares for erection as required, startup and commissioning spares as required, forwarding, proper packing, shipment and delivery at site, unloading, handling, transportation & storage at site, in site transportation, assembly, erection & commissioning, final painting at site, minor civil work, trial run at site, preparation and submission of drawing /documents including "As Built" drawings and O & M manuals, layout drawings in 2D & 3D ( As applicable) and carrying out performance guarantee /Functional / Demonstration tests at site (As applicable) & equipment /system guarantee/Aux. Guaranteed power consumption etc. inclusive of all prevailing taxes, duties and other levies and handover in flawless condition of the package specified above for above mentioned project to the end customer complete with all accessories for the total scope defined as per BHEL NIT & tender technical specification no. **PE-TS-417-155A-A001** for condensate polishing unit package of **5X800 MW YADADRI THERMAL POWER STATION**.

The Condensate Polishing Units (5 sets) with a common external regeneration system (2sets) and associated accessories shall conform to the technical specification (PE-TS-417-155A-A001) for **CONDENSATE POLISHING UNIT** of **5X800 MW YADADRI THERMAL POWER STATION**.

## 2.0 DESIGN CONDITIONS FOR CONDENSATE POLISHING UNIT

There shall be three service vessels (3X50%) for each 800 MW unit each polishing 50% of the condensate flow corresponding to VVO (valve wide open) condition at 1% make up (Flow through each service vessel indicated in the data sheet).

There shall be two common external regeneration facility shall be provided for station. For regeneration, resin from the exhausted Condensate Polisher Mixed Beds will be transferred hydraulically/hydro pneumatically to any one of the available common external regeneration facility.

All CPU service vessels of all 5 TG units shall be connected through pipe lines with both common external regeneration facilities so that any of the service vessel exhausted resins shall be transferred to any of the available regeneration system of CPU regeneration area.

There shall be two common external regeneration facility with interconnection shall be provided for station. For regeneration, resin from the exhausted Condensate Polisher Mixed Beds will be transferred hydraulically / hydro pneumatically to any one of the available common external regeneration facility. The DM water required for resin transfer, regeneration etc. shall be tapped off from DM water storage tank of DM Plant.

CPU regeneration facilities shall be located outside of TG hall near to DM plant (identified in plot plan BHEL Doc. No PE-DG-417-100-M001 R2 under sr. no. 10a). The approximate distance between CPU Regeneration facility and different Service vessel area of TG Units are as mentioned below.

Distance between CPU regeneration area and Service vessel area of TG unit -1 =1250 meter (Approx.)  
Distance between CPU regeneration area and Service vessel area of TG unit -2 =1100 meter (Approx.)  
Distance between CPU regeneration area and Service vessel area of TG unit -3 =1100 meter (Approx.)  
Distance between CPU regeneration area and Service vessel area of TG unit -4 =1250 meter (Approx.)  
Distance between CPU regeneration area and Service vessel area of TG unit -5 =1400 meter (Approx.)

Bidder to note that complete CPU package shall be supplied under two Stages (Stage -1 & Stage -2). Stage-1 CPU shall consist of TG hall area unit-1 & unit -2 and 1<sup>st</sup> set of regeneration system supplies and stage -2 CPU shall consist of TG hall area unit-3, unit-4 & unit -5 and 2<sup>nd</sup> set of regeneration system supplies along with interconnection of stage-2 CPU with stage-1 CPU.

GENERAL DESIGN DATA TABLE FOR SERVICE VESSEL AREA

| Sr.No. | Description                         | Parameter       |
|--------|-------------------------------------|-----------------|
| 1.     | Total Number of Vessels             | Three (3x50%)   |
| 2.     | CEP Discharge Pressure (Operating). | 31.27 kg/cm2(g) |



**TITLE:**  
**5X800 MW YADADRI THERMAL POWER  
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|     |                                                          |                |
|-----|----------------------------------------------------------|----------------|
| 3.  | CEP Shut off head                                        | 38.8 kg/cm2(g) |
| 4.  | Design Pressure of CPU,                                  | 47kg/cm2(g)    |
| 5.  | Condensate Flow (flow at VWO condition at 1% make up)    | 1648.061 t/hr  |
| 6.  | Condensate Flow (800 MW , 1% MU)                         | 1542.07 t/hr   |
| 7.  | Flow through each polisher vessel.(Design)               | 825 t/hr.      |
| 8.  | Condensate Temperature (Operating)                       | 42.4 Deg. C    |
| 9.  | Condensate Temperature Maximum (Process Design)          | 51.8 Deg. C    |
| 10. | Condensate Temperature (Mechanical Design)               | 60 Deg. C      |
| 11. | Service Run Cycle-Normal Run (Hrs)                       | 240 hrs        |
| 12. | Service Run Cycle-Start up condition (Hrs)               | 48 hrs         |
| 13. | Service Run Cycle-Condenser Tube Leakage condition (Hrs) | 48 hrs         |
| 14. | Average velocity of condensate through service vessels   | ≤ 120 m/ hour  |

### 3.0 BRIEF DESCRIPTION OF THE SYSTEM

The proposed condensate plant shall treat the entire condensate of the turbine generator of each unit of power station. The proposed schematic arrangement of the condensate polishing plant and its regeneration facility shall be as per the enclosed P&I Diagram. Arrangement of piping, valves and instruments shown in the P&ID are bare minimum. The bidder shall include the complete system including regeneration facility as elaborated in this specification meeting the contractual requirements.

The condensate polisher service vessels shall be located in the TG hall of each corresponding units. The resins shall be transferred to and from the common regeneration facility by sluicing through a pipeline hydraulically / hydro pneumatically.

The regeneration process offered by the bidder shall be of proven design and shall essentially be the same process by virtue of which the bidder is qualified and shall give resin-separation compatible with the desired effluent quality.

### 4.0 SCOPE OF SUPPLY (MECHANICAL)

Following are in bidder's scope of supply:

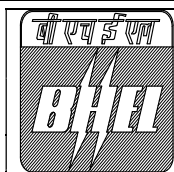
Bidder to note that complete CPU package shall be supplied under two Stages (Stage -1 & Stage -2). Stage-1 CPU shall consist of TG hall area unit-1 & unit -2 and 1<sup>st</sup> set of regeneration system supplies and stage -2 CPU shall consist of TG hall area unit-3, unit-4 & unit -5 and 2<sup>nd</sup> set of regeneration system supplies along with interconnection of stage-2 CPU with stage-1 CPU.

Broad scope of supply (mechanical) for this package is detailed below and as indicated in relevant portion of this specification.

#### A. SERVICE VESSEL FACILITY

- 1) There shall be three service vessels (3X50%) for each 800 MW unit, each polishing 50 % of the condensate flow. Total CPU service vessels for all 5 TG units shall be 15 numbers each polishing 50 % of the condensate flow of one TG unit.
- 2) Each Condensate polisher vessels shall be complete with condensate inlet and outlet connections, connections for resin transfer to and from the vessels, bed support-cum-under drain system, inlet water distributors, air distribution arrangement for resin mixing, all fittings and appurtenances etc. as specified and as required.
- 3) One no. External resin traps at the condensate & rinse outlet of each of the condensate polisher





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CONDENSATE POLISHING UNIT**

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mixed bed each designed for in-place manual back flushing facility. Total 15 nos. of external resin traps for all 5 TG units.

- 4) Condensate inlet and outlet headers for each installation with pipe connections to the condensate polisher vessels for each 800 MW TG unit.
- 5) Resin transfer headers and pipe lines of stainless steel construction connecting the both common external regeneration facilities to all the condensate polisher vessels of each installation (TG units) along with all necessary supports, anchors etc.
- 6) Rinse water outlet headers from condensate polisher vessels of each installation up to the condenser hot well of respective TG unit. Rinse water outlet headers from condensate-polisher vessels shall be provided with a pressure reducing valve and orifice plate, suitably designed to enable the water entry to the condenser hot well under all operating condition of condenser. The pressure reducing station shall consist of either a pressure reducing valve (reducing the pressure from design pressure of service vessel to condenser vacuum) or a combination of orifice plates to reduce pressure from design pressure of service vessel to 2 kg/cm<sup>2</sup> and a pressure reducing valve from 2 kg/cm<sup>2</sup> to condenser vacuum for each 800 MW TG unit.
- 7) All necessary valves, and fittings for the installations with actuators necessary for their remote operation from CP System Control Panel of each 800 MW Unit. These shall include suitable fool proof arrangement to prevent accidental over pressurization of the resin transfer pipeline and each regeneration facilities (1<sup>st</sup> set & 2<sup>nd</sup> set of regeneration facilities) connected to it, which are designed for pressure much lower than that of the Condensate Polisher Mixed Beds / Condensate Polisher Service vessels. It shall be PCV (Pressure Control Valve) with pressure controller and operable from DC and also provided with safety relief mechanism and the same shall be in bidder's scope.
- 8) A common drain header for the condensate polisher service vessel of unit up to the condenser hot well for each 800 MW TG unit. All necessary drains, vents and sampling points, with valves as specified and as required. The same shall be considered for all 5 TG units.
- 9) Gland sealing water piping for the Gland sealing valves in the rinse water line & other lines for each 800 MW TG unit. The same shall be considered for all 5 TG units.
- 10) Sample cooling line piping for sample cooling for all analysers for all 5 TG units.
- 11) Two nos. (1W + 1S) per unit oil free type air blowers with electric motor drives for each TG unit for supplying air required for mixing the resins in the service vessels. Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve etc. all mounted on a single base. Total service vessel area blowers to be supplied for all 5 TG units shall be 10 nos. each of 100% capacity along with the accessories as detailed above shall be supplied by bidder.
- 12) Two (2) nos. (2x100%), Rinse Recirculation pumps, each complete with electrical drive motor and all other accessories as required for each TG unit. Hence total 10 nos. of Rinse Recirculation pumps, each complete with electrical drive motor and all other accessories shall be supplied for all 5 TG units. Each pump shall be of 100% capacity.
- 13) Complete Instrumentation and Control for automatic operation.
- 14) Instruments racks & analyser racks for mounting pressure & flow transmitters, pressure switches, conductivity analysers & all other analysers etc. for each of condensate polisher mixed beds. The same is applicable of all 5 TG Units.
- 15) Emergency bypass between the condensate influent and effluent headers. Each Condensate polisher service unit shall be provided with an automatic bypass for the condensate polisher on the condensate inlet and outlet headers of the unit with a modulating butterfly type (flanged) control valve, along with lugged wafer type motorised butterfly isolation valves (resilient material seated, to ensure bubble tight shut off) on the upstream and downstream side of the control valve. The control valve shall be of 1x100% configuration to achieve proper control under all operating conditions. Isolation



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valve shall be provided with geared operators for manual operation. The same is applicable and provided for all 5 TG units.

In addition to control valve, one no. flanged motorized On/off type butterfly valve of similar capacity (i.e. 100%) shall be provided in the bypass line of control valve as per P&ID of the Condensate Polishing Unit. Further on the upstream and downstream side of this motorized On/off valve lugged wafer type butterfly isolation valves (resilient material seated, to ensure bubble tight shut off) shall be provided. Isolation valve shall be provided with geared operators for manual operation. The same is applicable and provided for all 5 TG units.

Complete instrumentation and controls for this emergency by-pass system for each TG unit. Further all tubing, wiring air sets and other fittings required to complete the system shall be provided for each TG unit. The same is applicable and provided for all 5 TG units.

- 16) The plant shall include resins for first fill of resins for all condensate polisher mixed beds, Mixed resin storage vessel of all 5 TG units i.e. Twenty (20) complete charges of resin. Further to this Resin for resin injection hoppers charge (150 liters for each resin injection hopper) shall also be provided separately. In addition, the above charges bidder to also provide make-up resin for first three years of operation and the same shall be in bidder's scope (Quantity of make-up resins shall be calculated on the basis of 3% and 5% attrition loss per annum for cation and anion resin respectively). Therefore, total resin quantity to be supplied for the project shall include total resin charges for all TG units (20 nos. resin charge) + Two (2) nos. resin injection hopper charge + Make up resin quantity (Make up resin quantity shall be calculated based on the basis of 3% and 5% attrition loss per annum for 3 years for total resin quantity (i.e. 20 charge resins+ 2 resin injection hopper charge) that will be supplied for the plant.

Deration factor of 10% for all resins shall be considered while calculating the quantity of resin to be supplied.

One resin charge shall be considered as resin required for one service vessel i.e. cation resin, anion resin and inert resin (if any) used for the project.

- 17) One no. specific Conductivity analyser at condensate common inlet header, one no. specific Conductivity Analyser at condensate common outlet header of each TG unit & One no. specific Conductivity Analyzer at individual outlet of each Condensate polishing Mixed Beds / Condensate Polisher Service vessels of all TG units. Hence total number of specific conductivity analysers to be supplied for all 5 TG units shall be 25 numbers for service vessel area.
- 18) One no. cation Conductivity Analyzer at condensate common outlet header of each TG unit & Three (3) nos. cation Conductivity Analyzer at outlet of each Condensate polishing Mixed Beds / Condensate Polisher Service vessels of all TG units. Hence total number of specific conductivity analysers to be supplied for all 5 TG units shall be 50 numbers for service vessel area.
- 19) One no. pH analyser at condensate inlet header, one no. pH analyser at condensate outlet header of each TG unit & one no. pH analyser at outlet of each Condensate polishing Mixed Beds / Condensate Polisher Service vessels of all TG units. Hence total number of pH analyser to be supplied for all 5 TG units shall be 25 numbers for service vessel area.
- 20) One no. multichannel (Four channel) sodium analyser to measure process value of each service vessel outlet & common condensate outlet header for each TG unit. Hence total number of multichannel (Four Channel) sodium analysers shall be five (5) nos. for all 5 TG units (service vessel area).
- 21) One no. multichannel (Four channel) Silica analyser to measure process value of each service vessel outlet & common condensate outlet header for each TG unit. Hence total number of multichannel (Four Channel) silica analysers shall be five (5) nos. for all 5 TG units (service vessel area).
- 22) Complete instrumentation and controls for this system, including the differential pressure transmitters, panel mounted indicating type controller with provision for remote manual operation, actuator for the



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control valve with positioner etc. All tubing, wiring, airsets, and other fittings, required to complete the system for each TG unit. The same is applicable for all 5 TG units and shall be provided by bidder.

- 23) All the piping, valves, fitting, accessories etc. used in service vessel area shall be 300# class minimum and this area shall be considered as high pressure side to complete the system for each TG unit shall be in bidder's scope. The same is applicable for all 5 TG units and shall be provided by bidder. Further rest shall be considered as low pressure side (regeneration area) and all piping, valves, fitting, accessories etc. used in regeneration area shall be of 150# class minimum.
- 24) Minimum instrumentation required shall be as per P & ID included in this tender specification. Further to meet the redundancy criterion as specified in section IC, if any instrument, transmitter & analyzer required shall be included by bidder service vessel area and shall be in bidder's scope and shall be provided by bidder without any price and delivery implication to BHEL & customer.
- 25) All butterfly valves MOC used in service vessel area in condensate inline line shall be (body: WCB Disc:CF8M/SS316) and condensate outlet line will be (Body & Disc both: CF8M/SS316). Further to this valves used in rinse to condenser hot well line and suction and discharge of rinse recirculation pumps shall be (Body & Disc both: CF8M/SS316).
- 26) Condensate Inlet piping & condensate outlet piping (as marked in P&ID of CPU) to each condensate polisher mixed bed & up to the common outlet line shall be CSRL (SA 106 Gr-C with 3.0 mm thick rubber lining) for all TG units.
- 27) All instrument air distribution for SOV shall be through SS-316 manifold with SS-316 isolation and auto drain traps.
- 28) Solenoid valve shall be kept in pneumatic junction boxes only. Air distribution for SOV's shall be through -316 manifold and SS-316 isolation valves only and SS tubing from SOV to valve shall not be more than 6 meters.
- 29) Instrument and transmitter provided in Resin line, Resin slurry line (Resin with DM water) and DM waterline shall be of capillary diaphragm type only.
- 30) All non-stainless steel pipe colour coding shall be provided by bidder during detail engineering.
- 31) Motor operated valve instead of pneumatic isolation valve shall be provided for each CPU to DM water line as indicated in P&ID. Further if any valve which is not indicated or indicated as pneumatic in tender P&ID the same shall be considered by bidder as Motorized isolation valve.
- 32) All nuts, bolts etc. in submerged and corrosive application shall be of SS-316.

**B. REGENERATION SYSTEM**

The regeneration system (2 sets) with interconnection (one interconnection of resin transfer line and one interconnection of DM water line in regeneration area & one interconnection of resin transfer line and one interconnection of DM water line nearby service vessel area as indicated in P&ID of CPU) shall be common to polisher of all five (5) TG units and shall be external. The interconnection shall be done in such a manner that anyone of CPU regeneration cum resin transfer pumps shall be utilised to supply DM water for resin transfer to any of the service vessel of any TG unit and similarly any of the resin transfer line shall be utilised for transferring the resin from anyone of the service vessel of any TG unit to any one of available two regeneration system of regeneration area. For this purpose, minimum number of valves as shown in CPU P&ID shall be provided by bidder. Any additional number of valves required to achieve the same, shall be included by bidder in bidder's scope and shall be provided by bidder during detail engineering without any price and delivery implication to BHEL & customer.

The CPU regeneration system will be located near DM plant area. Regeneration area shall be considered as low pressure area.



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The Acid and alkali unloading equipment for regeneration of condensate polishing resins shall preferably be mounted on skid. In order to facilitate erection at site chemical dosing preparation equipment shall be mounted on structural steel skids and assembled (including piping) at the manufacturer's shop, to the maximum extent possible, prior to shipping. The number of mechanical connections shall be minimized by the use of pipe headers wherever possible. The bidder may also supply and install this equipment's independently instead of assembling the skids. Complete facility for preparing alkali solution from alkali lye & flakes shall be included in Bidder's scope.

The Acid and alkali dosing equipment for regeneration of condensate polishing resins shall preferably be mounted on skid and shall be in bidder's scope. All the equipment, piping etc. shall be assembled on two structural steel skids one for acid and one alkali dosing equipment.

Complete regeneration facility (2 sets) with interconnection as mentioned below and as indicated in P & ID of CPU shall be in Bidder's scope:

I. The 1<sup>st</sup> set of Regeneration System Shall consist of following below mentioned items and shall be provided by the bidder:

- 1) One (1) no. Resin Separation & Cation Regeneration Vessel complete with all accessories.
- 2) One (1) no. Anion resin regeneration vessel complete with all accessories.
- 3) One (1) no. mixed resin storage Vessel complete with all accessories.
- 4) All vessels must be complete with vents, drains, piping & valves for air scrubbing, back-washing & regeneration process.
- 5) All internals, fittings and appurtenances for these vessels as indicated under sr. no. 1,2 & 3 above.
- 6) One (1) no. common waste effluent header with resin trap in each waste effluent header designed for in place manual backwashing.
- 7) The equipment and accessories for external regeneration as indicated above (s.no 1, 2 and 3) of ion exchange resins are tentative. However, any other proven alternative scheme of external regeneration as per the standard practice of Supplier of CPU System may also be adopted subject to suitability of the same in all respects for satisfactory operation and performance of Condensate Polisher Mixed Beds. However, design requirement shall be as per tender specification.
- 8) Resin Make up/injection hopper complete with water ejector system for resin make up. Resin make Up /injection hopper shall be sized to handle up to minimum 150 liters of as received new resins per Single injection or maximum attrition loss whichever is higher.
- 9) Two (2) nos. (1W+1S) oil free type air blowers with electric motor drives, for supplying all the process air required for cleaning of the resins and their regeneration processes. Further these blowers shall be also used for air agitation of neutralisation pit (both compartments). Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve, anti-vibration pads etc.as required and shall be mounted on a single base.
- 10) Two (2) nos. CPU Regeneration cum Resin Transfer Pumps (located in DM transfer pump house) each with electric drive motor drives, one normally operating and the other standby, for water supply for chemical preparation / dosing, dilution and transfer of resin from service vessel to regeneration vessels & vice-versa, backwash & rinse activities shall be provided. These CPU Regeneration cum Resin Transfer Pumps will take suction from DM water storage tanks (DM water storage tanks not in bidder's scope).
- 11) One (1) no. resin trap at common discharge line of CPU regeneration vessels.
- 12) Two (2) numbers (2X100%) simplex hydraulically operated diaphragm type, positive displacement acid dosing pumps for regeneration, each complete with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump along with all other required accessories for acid

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dosing.

- 13) One (1) no. (1X100%) acid measuring tank for regeneration complete with fume absorbers, overflow seal pot, integral pipe works, valves, instrumentation and all other accessories required. Tank capacity shall be equal to 120% of regeneration requirement of one regeneration.
- 14) Two (2) nos. (2X100%) Alkali transfer cum recirculation pumps each complete with electrical drive motor and all other accessories as required. These pumps shall take suction from bulk alkali storage tank. These pumps shall be provided with a pulsation dampener at the outlet header of each pump along with necessary valves & instrumentation & accessories as required.
- 15) One (1) no. Activated carbon filter for alkali complete with internals, integral pipe works, valves, instrumentation, manhole, hand hole etc. and all other accessories as required. One (1) no. Activated Carbon Filter for alkali rated flow of each filter shall not be less than the design capacity of the alkali unloading pump/alkali transfer cum recirculation pump (as applicable), and the maximum velocity through each activate carbon filter for this flow shall not exceed 15 meters/hour. Depth of the filter materials shall not be less than 1.2 meter in activated carbon filter.
- 16) One number carbon trap shall be provided at the outlet line of Activated carbon filter (ACF). This carbon trap shall have screen opening of 60 mesh.
- 17) Two (02) numbers (2X100%) simplex hydraulically operated diaphragm type, positive displacement alkali dosing pumps for regeneration, each complete with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump along with all other required accessories for alkali dosing.
- 18) One (1) no. (1X100%) alkali measuring cum preparation tank for regeneration complete with slow speed agitator driven by motor complete with carbon dioxide absorber, overflow seal pot, dissolving basket, integral pipe works, valves, instrumentation and all other accessories required. The tank capacity shall be equal to 120% of regeneration requirement of one regeneration.
- 19) One (1) no. (1X100%) hot water tank for heating of alkali diluent water for anion resins with (2X60%) electric heating coil, adequately insulated of carbon steel rubber lined construction shall be provided complete with integral pipe works, valves, instrumentation and all other accessories required shall be provided. The effective capacity of the hot water tank is suitable to meet the requirements for alkali injection and alkali displacement in course of single regeneration of a Condensate Polisher Mixed Bed, plus 20% margin. This tank shall be provided with burn out protection, pressure relief valve, level transmitter, temperature indicator etc. The heaters shall be sized for heating the water from a temperature of 15 to 50 deg. C in 5 hours at the outlet of ejector.
- 20) Diluent water supply separately, for acid and alkali, each provided with an automatic on-off valve, a throttling valve for setting of flow, a local flow indicator with flow transmitter and a mixing tee where the chemicals get injected into the water stream.
- 21) 2 nos. concentration analyser for measuring density of diluted acid & alkali shall be provided, one (1) in acid dilution line and one (1) in alkali dilution line. This concentration analyser shall be provided in addition to mechanical density indicator in each line.
- 22) All the equipment, piping etc. shall be assembled on two structural steel skids one for acid and one for alkali dosing equipment. The bidder shall supply all anchor bolts, foundation plates, sleeves, nuts, inserts etc. to be embedded in concrete for these equipment skids. The length of the foundation bolts shall be liberally sized to reach below the reinforcement level. Each equipment skid shall be provided with suitable lighting lugs, eye bolts etc. to facilitate erection and maintenance.
- 23) One (1) no. hose Station for Transfer of Hydrochloric Acid (30-33% HCl). The hose station shall consist of two (2) sets of rubber hoses each of size 80 mm /NB @ 20 m, provided along with coupling & Diaphragm type isolation valves.
- 24) Two (2) nos. (2X100%) Hydrochloric acid unloading / transfer pumps each complete with electrical drive motor, necessary valves & instrumentation and all other accessories as required. These pumps

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shall take suction from the unloading tankers.

- 25) Two (2) nos. Bulk Acid storage tank complete with integral pipe works, valves, radar type level transmitters, level gauges, fume absorber cum overflow seal pot, instrumentation, manhole, ladder and platform and all other accessories required. Capacity of both tanks together shall adequate to hold the quantity of commercial Acid (30-33% HCl) required for thirty (30) days of operation of 2 TG Units cation resin regeneration requirement & acid required to neutralise the excess alkali present in effluent generated from the one regeneration waste.
- 26) One (1) no. hose Station for Transfer of Alkali (48% NaOH). The hose station shall consist of two (2) sets of rubber hoses each of size 80 mm /NB @ 20 m, provided along with coupling & Diaphragm type isolation valves.
- 27) Two (2) nos. Alkali unloading/transfer pumps, each complete with electrical drive motor, necessary valves & instrumentation and all other accessories as required. These pumps shall take suction from the unloading tankers.
- 28) Two (2) nos. Bulk Alkali storage tank complete with integral pipe works, valves, ultrasonic type level transmitters, level gauges, CO<sub>2</sub> absorber, over flow seal pot, instrumentation, manhole, ladder and platform and all other accessories required. Capacity of both tanks together shall adequate to hold the quantity of commercial Alkali (48%NaOH) required for thirty (30) days of operation of 2 TG Units anion resin regeneration requirement & alkali required to neutralise the excess acid present in effluent generated from the one regeneration waste.
- 29) All integral pipe works, valves, internals, fittings, hangers, supports and appurtenances etc. for these vessels, atmospheric tanks & dosing pumps as well as unloading and transfer pumps. All necessary suction and discharge piping for these pumps including all strainers, valves and fittings as required, up to the mixing tee with the diluent water. Further flushing connections to all dosing, unloading and transfer pumps shall be provided with service water along with an isolation valves for individual pumps and for drain arrangement shall be provided with an isolation valves for individual pumps as shown in P&ID of CPU.
- 30) All interconnecting piping, valves and fittings & instrumentation as required to complete the 1<sup>st</sup> set of CPU regeneration system and interconnection piping, valves and fittings & instrumentation required for its interconnection with 2<sup>nd</sup> set of regeneration system shall be in bidder's scope.
- 31) One (1) no. Neutralization Pit of RCC construction (civil work not in bidder's scope) with two (2) compartments with PVC lining along with 2nos. isolation gates for each compartment shall be provided in the CPU regeneration area. Each section/compartment shall have capacity to hold 120% of waste water generated from CPU in one regeneration. Dosing of acid and alkali shall also be provided to neutralize effluents of CPU regeneration waste before disposal.
- 32) One (1) no. (1X100%) Acid Measuring Tank for Neutralization- pit complete with fume absorbers, over flow seal pot, flanges, integral pipe works, pneumatic valves & instruments all other fitting and accessories as required shall be supplied by bidder. Capacity of the AMT for N-pit is Adequate to hold the quantity of acid required for neutralization of excess alkali in waste effluent due to one regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.
- 33) One (1) no. (1X100%) Alkali Measuring Tank for neutralization-pit along with slow speed agitator driven by motor and complete with CO<sub>2</sub> absorbers, over flow seal pot, dissolving basket, flanges, integral pipe works, pneumatic valves & instruments all other fitting and accessories as required shall be supplied by bidder. Capacity of the ALMT for N-pit Adequate to hold the quantity of alkali required for neutralization of excess acid in waste effluent due to one regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.
- 34) Two (2) nos. (2 x 100%) capacity Neutralized Waste Transfer cum Recirculation Pumps of vertical centrifugal type, each complete with electrical drive motor along with necessary valves, instrumentation, piping, flanges, fittings and accessories as required. These pumps shall be supplied for waste recirculation and disposal to CMB of ETP. The pump shall be designed to pump the total



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volume of one section/ compartment of the neutralization pit in 4 hours or 100 m<sup>3</sup>/ hr (whichever is higher). Proven agitation system like air agitation, venture mixing etc. shall be provided in addition to recirculation from pumps.

- 35) Three nos. pH analyser at effluent discharge header, shall be in the scope of bidder.
- 36) All interconnecting piping, valves, instrumentation and fittings as required for the N-pit and N-pit disposal system.
- 37) Further all interconnecting piping, valves, instrumentation and fittings as required for the complete CPU regeneration system shall be in bidder's scope.

**II.** The 2<sup>nd</sup> set of Regeneration System Shall consist of following below mentioned items and shall be provided by the bidder:

- 1) One (1) no. Resin Separation & Cation Regeneration Vessel complete with all accessories.
- 2) One (1) no. Anion resin regeneration vessel complete with all accessories.
- 3) One (1) no. mixed resin storage Vessel complete with all accessories.
- 4) All vessels must be complete with vents, drains, piping & valves for air scrubbing, back-washing & regeneration process.
- 5) All internals, fittings and appurtenances for these vessels as indicated under sr. no. 1,2 & 3 above.
- 6) One (1) no. common waste effluent header with resin trap in each waste effluent header designed for in place manual backwashing.
- 7) The equipment and accessories for external regeneration as indicated above (s.no 1, 2 and 3) of ion exchange resins are tentative. However, any other proven alternative scheme of external regeneration as per the standard practice of Supplier of CPU System may also be adopted subject to suitability of the same in all respects for satisfactory operation and performance of Condensate Polisher Mixed Beds. However, design requirement shall be as per tender specification.
- 8) Resin Make up/injection hopper complete with water ejector system for resin make up. Resin make Up /injection hopper shall be sized to handle up to minimum 150 liters of as received new resins per Single injection or maximum attrition loss whichever is higher.
- 9) Two (2) nos. (1W+1S) oil free type air blowers with electric motor drives, for supplying all the process air required for cleaning of the resins and their regeneration processes. Further these blowers shall be also used for air agitation of neutralisation pit (both compartments). Each blower shall be complete with motor, V-belt drive with belt guard, inlet filter, silencer, flexible couplings and discharge snubber, acoustic hood, relief valve, anti-vibration pads etc.as required and shall be mounted on a single base.
- 10) Two (2) nos. CPU Regeneration cum Resin Transfer Pumps (located in DM transfer pump house) each with electric drive motor drives, one normally operating and the other standby, for water supply for chemical preparation / dosing, dilution and transfer of resin from service vessel to regeneration vessels & vice-versa, backwash & rinse activities shall be provided. These CPU Regeneration cum Resin Transfer Pumps will take suction from DM water storage tanks (DM water storage tanks not in bidder's scope).
- 11) One (1) no. resin trap at common discharge line of CPU regeneration vessels.
- 12) Two (2) numbers (2X100%) simplex hydraulically operated diaphragm type, positive displacement acid dosing pumps for regeneration, each complete with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump along with all other required accessories for acid dosing.
- 13) One (1) no. (1X100%) acid measuring tank for regeneration complete with fume absorbers, overflow seal pot, integral pipe works, valves, instrumentation and all other accessories required. Tank



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capacity shall be equal to 120% of regeneration requirement of one regeneration.

- 14) Two (2) nos. (2X100%) Alkali transfer cum recirculation pumps each complete with electrical drive motor and all other accessories as required. These pumps shall take suction from bulk alkali storage tank. These pumps shall be provided with a pulsation dampener at the outlet header of each pump along with necessary valves & instrumentation & accessories as required.
- 15) One (1) no. Activated carbon filter for alkali complete with internals, integral pipe works, valves, instrumentation, manhole, hand hole etc. and all other accessories as required. One (1) no. Activated Carbon Filter for alkali rated flow of each filter shall not be less than the design capacity of the alkali unloading pump/alkali transfer cum recirculation pump (as applicable), and the maximum velocity through each activate carbon filter for this flow shall not exceed 15 meters/hour. Depth of the filter materials shall not be less than 1.2 meter in activated carbon filter.
- 16) One number carbon trap shall be provided at the outlet line of Activated carbon filter (ACF). This carbon trap shall have screen opening of 60 mesh.
- 17) Two (02) numbers (2X100%) simplex hydraulically operated diaphragm type, positive displacement alkali dosing pumps for regeneration, each complete with electric motor drive, pulsation dampener & safety relief valve at the outlet header of each pump along with all other required accessories for alkali dosing.
- 18) One (1) no. (1X100%) alkali measuring cum preparation tank for regeneration complete with slow speed agitator driven by motor complete with carbon dioxide absorber, overflow seal pot, dissolving basket, integral pipe works, valves, instrumentation and all other accessories required. The tank capacity shall be equal to 120% of regeneration requirement of one regeneration.
- 19) One (1) no. (1X100%) hot water tank for heating of alkali diluent water for anion resins with (2X60%) electric heating coil, adequately insulated of carbon steel rubber lined construction shall be provided complete with integral pipe works, valves, instrumentation and all other accessories required shall be provided. The effective capacity of the hot water tank is suitable to meet the requirements for alkali injection and alkali displacement in course of single regeneration of a Condensate Polisher Mixed Bed, plus 20% margin. This tank shall be provided with burn out protection, pressure relief valve, level transmitter, temperature indicator etc. The heaters shall be sized for heating the water from a temperature of 15 to 50 deg. C in 5 hours at the outlet of ejector.
- 20) Diluent water supply separately, for acid and alkali, each provided with an automatic on-off valve, a throttling valve for setting of flow, a local flow indicator with flow transmitter and a mixing tee where the chemicals get injected into the water stream.
- 21) 2 nos. concentration analyser for measuring density of diluted acid & alkali shall be provided, one (1) in acid dilution line and one (1) in alkali dilution line. This concentration analyser shall be provided in addition to mechanical density indicator in each line.
- 22) All the equipment, piping etc. shall be assembled on two structural steel skids one for acid and one for alkali dosing equipment. The bidder shall supply all anchor bolts, foundation plates, sleeves, nuts, inserts etc. to be embedded in concrete for these equipment skids. The length of the foundation bolts shall be liberally sized to reach below the reinforcement level. Each equipment skid shall be provided with suitable lighting lugs, eye bolts etc. to facilitate erection and maintenance.
- 23) One (1) no. hose Station for Transfer of Hydrochloric Acid (30-33% HCl). The hose station shall consist of two (2) sets of rubber hoses each of size 80 mm /NB @ 20 m, provided along with coupling & Diaphragm type isolation valves.
- 24) Two (2) nos. (2X100%) Hydrochloric acid unloading / transfer pumps each complete with electrical drive motor, necessary valves & instrumentation and all other accessories as required. These pumps shall take suction from the unloading tankers.
- 25) Two (2) nos. Bulk Acid storage tank complete with integral pipe works, valves, radar type level transmitters, level gauges, fume absorber cum overflow seal pot, instrumentation, manhole, ladder



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and platform and all other accessories required. Capacity of both tanks together shall adequate to hold the quantity of commercial Acid (30-33%HCl) required for thirty (30) days of operation of 3 TG Units cation resin regeneration requirement & acid required to neutralise the excess alkali present in effluent generated from the one regeneration waste.

- 26) One (1) no. hose Station for Transfer of Alkali (48% NaOH). The hose station shall consist of two (2) sets of rubber hoses each of size 80 mm /NB @ 20 m, provided along with coupling & Diaphragm type isolation valves.
- 27) Two (2) nos. Alkali unloading/transfer pumps, each complete with electrical drive motor, necessary valves & instrumentation and all other accessories as required. These pumps shall take suction from the unloading tankers.
- 28) Two (2) nos. Bulk Alkali storage tank complete with integral pipe works, valves, ultrasonic type level transmitters, level gauges, CO2 absorber, over flow seal pot, instrumentation, manhole, ladder and platform and all other accessories required. Capacity of this tank shall adequate to hold the quantity of commercial Alkali (48%NaOH) required for thirty (30) days of operation of 3 TG Units anion resin regeneration requirement & alkali required to neutralise the excess acid present in effluent generated from the one regeneration waste.
- 29) All integral pipe works, valves, internals, fittings, hangers, supports and appurtenances etc. for these vessels, atmospheric tanks & dosing pumps as well as unloading and transfer pumps. All necessary suction and discharge piping for these pumps including all strainers, valves and fittings as required, up to the mixing tee with the diluent water. Further flushing connections to all dosing, unloading and transfer pumps shall be provided with service water along with an isolation valves for individual pumps and for drain arrangement shall be provided with an isolation valves for individual pumps as shown in P&ID of CPU.
- 30) All interconnecting piping, valves and fittings & instrumentation as required to complete the 2<sup>nd</sup> set of CPU regeneration system and interconnection piping, valves and fittings & instrumentation required for its interconnection with 1<sup>st</sup> set of regeneration system shall be in bidder's scope.
- 31) One (1) no. Neutralization Pit of RCC construction (civil work not in bidder's scope) with two (2) compartments with PVC lining along with 2 nos. isolation gates for each compartment shall be provided in the CPU regeneration area. Each section/compartment shall have capacity to hold 120% of waste water generated from CPU in one regeneration. Dosing of acid and alkali shall also be provided to neutralize effluents of CPU regeneration waste before disposal.
- 32) One (1) no. (1X100%) Acid Measuring Tank for Neutralization- pit complete with fume absorbers, over flow seal pot, flanges, integral pipe works, pneumatic valves & instruments all other fitting and accessories as required shall be supplied by bidder. Capacity of the AMT for N-pit is Adequate to hold the quantity of acid required for neutralization of excess alkali in waste effluent due to one regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.
- 33) One (1) no. (1X100%) Alkali Measuring Tank for neutralization-pit along with slow speed agitator driven by motor and complete with CO2 absorbers, over flow seal pot, dissolving basket, flanges, integral pipe works, pneumatic valves & instruments all other fitting and accessories as required shall be supplied by bidder. Capacity of the ALMT for N-pit Adequate to hold the quantity of alkali required for neutralization of excess acid in waste effluent due to one regeneration of a Condensate Polisher Mixed Bed with 20% overall margin.
- 34) Two (2) nos. (2 x 100%) capacity Neutralized Waste Transfer cum Recirculation Pumps of vertical centrifugal type, each complete with electrical drive motor along with necessary valves, instrumentation, piping, flanges, fittings and accessories as required. These pumps shall be supplied for waste recirculation and disposal to CMB of ETP. The pump shall be designed to pump the total volume of one section/ compartment of the neutralization pit in 4 hours or 100 m<sup>3</sup>/ hr (whichever is higher). Proven agitation system like air agitation, venture mixing etc. shall be provided in addition to recirculation from pumps.



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- 35) Three nos. pH analyser at effluent discharge header, shall be in the scope of bidder.
- 36) All interconnecting piping, valves, instrumentation and fittings as required for the N-pit and N-pit disposal system.
- 37) Further all interconnecting piping, valves, instrumentation and fittings as required for the complete CPU regeneration system shall be in bidder's scope.

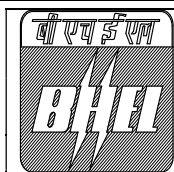
**III. Common Requirement of both the regeneration system shall consist of following:**

- 1) Three (3) no. personnel water drench shower/safety shower and eye bath with necessary accessories in regeneration area shall be provided by the bidder.
- 2) All the pressure vessels (except service vessels) shall be designed for a pressure that is maximum expected pressure to which the vessel may be subjected plus 5% extra margin, Maximum expected pressure for vessels placed in the discharge line of pumps shall be based on the shut-off head of the pumps plus static head at pump suction or 10 kg/cm<sup>2</sup>(g) whichever is higher.
- 3) Further all measuring tanks and storage tanks shall be designed for atmospheric pressure.
- 4) Four (4) sets of safety equipment comprising PVC protection suits with hoods, rubber boots, face visors and thick PVC gauntlets shall also be provided by bidder.
- 5) Bidder to include one no toilet block having facilities for Ladies & Gents as per attached Space available for CPU Regeneration area (Vide BHEL Ref. Dwg. No. PE-DG-417-155A-A003).
- 6) All instrument air distribution for SOV shall be through SS-316 manifold with SS-316 isolation and auto drain traps.
- 7) Solenoid valve shall be kept in pneumatic junction boxes only. Air distribution for SOV's shall be through -316 manifold and SS-316 isolation valves only and SS tubing from SOV to valve shall not be more than 6 meters.
- 8) Instrument and transmitter provided in Resin line, Resin slurry line (Resin with DM water) and DM waterline shall be of capillary diaphragm type only.
- 9) All non-stainless steel pipe colour coding shall be provided by bidder during detail engineering.
- 10) Motor operated valve instead of pneumatic isolation valve shall be provided for each CPU to DM water line as indicated in P&ID. Further if any valve which is not indicated or indicated as pneumatic in tender P&ID the same shall be considered by bidder as Motorized isolation valve.
- 11) All nuts, bolts etc. in submerged and corrosive application shall be of SS-316.

**IV. Effluent Neutralization System:**

Neutralization pit of RCC construction with inside lined with PVC sheet (3 mm thick) shall be provided for 1st set regeneration facilities & 2nd set regeneration facilities separately. 1st set regeneration facilities neutralization pit shall be provided in two compartments and each compartment shall have a holding capacity to hold the quantity of waste effluent generated due to one regeneration of Condensate Polisher Mixed Beds of plus 20% overall margin. Similarly, 2nd set regeneration facilities neutralization pit shall be provided in two compartments and each compartment shall have a holding capacity to hold the quantity of waste effluent generated due to one regeneration of Condensate Polisher Mixed Beds of plus 20% overall margin. The regeneration waste shall be led to the N- pit through drain. For further disposal of effluents from CPU Regeneration area N-pit two nos. (2X100%) Effluent disposal pumps shall be provided for N-pit of 1st set regeneration facilities. Similarly, for further disposal of effluents from CPU Regeneration Area N-pit two nos. (2X100%) Effluent disposal pumps shall be provided for N-pit of 2nd set regeneration facilities.

2 nos. isolation gates for each compartment/section of each N-pit shall be provided by bidder. Hence



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total 8 number gates shall be provided for effluent neutralization system of 2 sets of CPU regeneration system of common external regeneration area.

Dosing of acid and alkali shall also be provided to neutralize effluents of CPU regeneration waste before disposal to Central Monitoring basin(CMB) of ETP.

**C. PIPING**

All the piping as listed below shall be in bidder's scope. The below indicated pipes shall be designed, supplied, erected, laid and tested by the bidder. Elbows, tees, flanges, counter flanges, Hangers and supports, embedment plates with lugs etc. required for the below given piping shall also be provided by the bidder.

- 1) Service vessel inlet header shall be SA 106 Gr-C (OD 457.2 X 12.7 mm thick) with Rubber lining as indicated in CPU P&ID for each TG unit. Complete piping of all 5 TG units shall be in bidder's scope.
- 2) Service vessel outlet header shall be SA 106 Gr C (OD 457.2 X 12.7 mm thick) with Rubber lining as indicated in CPU P&ID for each TG unit. Complete piping of all 5 TG units shall be in bidder's scope.
- 3) Service vessel by pass line piping shall be SA 106 Gr-C (OD 457.2 X 12.7 mm thick) for each TG unit. Complete piping of all 5 TG units shall be in bidder's scope.
- 4) Rinse water outlet piping shall be SA 106 Gr-B (OD 168.3 x 7.11 mm). The distance between CPU service vessel to condenser hot well shall be considered as 100 meter for each TG unit (Total 500 m for all 5 TG units) and this piping shall be in bidder's scope. Complete piping of all 5 TG units shall be in bidder's scope.
- 5) Rinse recirculation piping confirming to CS to SA 106 Gr-B, complete rinse recirculation piping of each TG unit shall be in bidder's scope. Complete piping of all 5 TG units shall be in bidder's scope.
- 6) Resin transfer piping shall be minimum 80 NB and of ASTM A 312 Gr. TP 304 (SS 304) Sch 10S (minimum). One-way distance for resin Transfer Piping between farthest service vessel of TG unit -1 and 1<sup>st</sup> set of regeneration system located in regeneration area shall be minimum 1250 m. In addition to that complete resin transfer piping shall be in bidder's scope which shall include resin transfer piping of TG unit -1, 2 from 1<sup>st</sup> set of regeneration system, piping inside 1<sup>st</sup> set of regeneration area & Service vessel areas unit -1 & 2 equipment's also, the minimum length of this piping shall be 150 meter.
- 7) Resin transfer piping shall be minimum 80 NB and of ASTM A 312 Gr. TP 304 (SS 304) Sch 10S (minimum). One-way distance for resin Transfer Piping between farthest service vessel of TG unit -5 and 2<sup>nd</sup> set of regeneration system located in regeneration area shall be minimum 1400 m. In addition to that complete resin transfer piping shall be in bidder's scope which shall include resin transfer piping of TG unit -3, 4 & 5 from 2<sup>nd</sup> set of regeneration system, piping inside 2<sup>nd</sup> set of regeneration area & Service vessel areas unit -3, 4 & 5 equipment's also, the minimum length of this piping shall be 250 meter.
- 8) Piping handling DM water shall be ASTM A 312 Gr. TP 304 (SS 304) Sch 10S (minimum). One-way distance for DM water piping between farthest service vessel of TG unit -1 and CPU regeneration cum resin transfer pumps located in DM transfer pump house of 1<sup>st</sup> set of regeneration system shall be 1250 m. Further complete DM water piping shall be in bidder's scope which shall include DM water piping of TG unit -1, 2 from 1<sup>st</sup> set of regeneration system, piping inside 1<sup>st</sup> set of regeneration area & Service vessel areas unit -1 & 2 equipment's also, the minimum length of this piping shall be 400 meter.
- 9) Piping handling DM water shall be ASTM A 312 Gr. TP 304 (SS 304) Sch 10S (minimum). One-way distance for DM water piping between farthest service vessel of TG unit -5 and CPU regeneration cum resin transfer pumps located in DM transfer pump house of 2<sup>nd</sup> set of regeneration system shall be 1400 m. Further complete DM water piping shall be in bidder's scope which shall include DM water piping of TG unit -3, 4, & 5 from 2<sup>nd</sup> set of regeneration area & Service vessel areas unit -3, 4 & 5 equipment's also, the minimum length of this piping shall be 500 meter.
- 10) Distance Between CPU regeneration area stage 1& 2 and DM water transfer pumps shall be approx. 200 meters. Similarly distance between CPU regeneration area stage 1& 2 and DM water storage tanks shall be approximately 250 m.

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- 11) Interconnection piping along with isolation valves, tee, bends and flanges along with instruments between Resin transfer lines & DM water lines of CPU regeneration area stage-1 and stage -2 in service vessel area as well as regeneration area shall be in bidder's scope and the same shall be provided by bidder.
- 12) N-Pit effluent common discharge piping from N-Pit effluent transfer pumps of 1<sup>st</sup> set of regeneration system to ETP of CMB shall be minimum 150 NB size or as per velocity criterion for sizing given in technical specification whichever is higher of MOC CSRL shall be in bidder's scope. The distance between N-Pit of 1<sup>st</sup> set of regeneration system and CMB (common monitoring basin) of ETP shall be 1500 m and this piping shall be in bidder's scope. Complete N-pit effluent discharge piping of CPU regeneration system shall be in bidder's scope.
- 13) N-Pit effluent common discharge piping from N-Pit effluent transfer pumps of 2<sup>nd</sup> set of regeneration system to ETP of CMB shall be minimum 150 NB size or as per velocity criterion for sizing given in technical specification whichever is higher of MOC CSRL shall be in bidder's scope. The distance between N-Pit of 2<sup>nd</sup> set of regeneration system and CMB (common monitoring basin) of ETP shall be 1500 m and this piping shall be in bidder's scope. Complete N-pit effluent discharge piping of CPU regeneration system shall be in bidder's scope.
- 14) Piping used for handling alkali (concentrated) and alkali solution shall be CPVC Sch. 80 minimum for complete CPU regeneration area. The distribution of the same inside the CPU regeneration (1<sup>st</sup> stage & 2<sup>nd</sup> stage) shall be in bidder's scope.
- 15) Piping handling acid service shall be CPVC Sch. 80 minimum for complete CPU regeneration area. The distribution of the same inside the CPU regeneration (1<sup>st</sup> stage & 2<sup>nd</sup> stage) shall be in bidder's scope.
- 16) Piping for the instrument & service air conforming to SS 304 Sch 40S for size equal to & less than 50 NB and SS 304 Sch 10S for size equal to & more than 65 NB. The distribution of the same inside the CPU regeneration area and CPU service vessel area shall be in bidder's scope
- 17) All piping within each of the above skids/equipment for both the regeneration system (1<sup>st</sup> stage & 2<sup>nd</sup> stage) shall be in bidder's scope.
- 18) Similarly, DM water piping from DM water storage tanks common outline header line to each CPU REGENERATION CUM RESIN TRANSFER PUMPS (located in DM water transfer pump house) suction lines along with their isolation valves, tee, bends, piping and flanges shall be in bidder's scope.
- 19) Similarly, DM water piping from each CPU REGENERATION CUM RESIN TRANSFER PUMPS (located in DM water transfer pump house) discharge recirculation line to common recirculation header along with their isolation valves, tee, bends, piping and flanges shall be in bidder's scope.
- 20) Further DM water piping from each CPU REGENERATION CUM RESIN TRANSFER PUMPS to service vessel area of all 5 TG units and 1<sup>st</sup> stage & 2<sup>nd</sup> stage regeneration area all equipments shall be in bidder's scope.
- 21) Service water piping (used for cooling of condensate sample & other activities in regeneration area), piping for gland sealed valve cooling, instrument air piping and service air piping, potable water piping for eye wash & other applications etc. shall be in bidder's scope.
- 22) Similarly, all piping between the external regeneration facility (1<sup>st</sup> stage & 2<sup>nd</sup> stage) and the skids for chemical dosing and acid/alkali preparation, and acid & alkali storage shall also be designed, supplied, erected and tested by the bidder. These shall include demineralized water piping to the chemical dosing, acid /alkali piping from external bulk storage tanks to respective preparation skids, the alkali preparation skids from the external regeneration facility, alkali solution from its preparation facility to the alkali dosing skid, dilute chemical solution piping for acid and alkali from the dosing skids to the external regeneration facility, piping to the preparation/dosing facilities, instrument air piping and power supply for immersion heaters of the diluent water tank from the regeneration facility, and all instrumentation and control wiring between these skids, etc.
- 23) In addition, any additional piping and associated accessories required to complete the system shall be in bidder's scope.

NOTE: There will be no price implication to BHEL/Customer from bidder's side due to addition / deletion in



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piping, when the piping quantity increases  $\pm 10\%$  from the specified quantity in the technical specification. Layout and routing shall be finalized during detailed engineering. However, system shall be designed to take care of any increase or decrease in length of piping.

**D. ADDITIONAL REQUIREMENT**

- 1) Operating platforms, ladders, supports and other structural works for each vessel to facilitate accessibility for operation and maintenance for all the condensate polisher mixed beds, regeneration vessels, storage tanks, alkali and acid measuring tanks & preparation tanks and other equipment's etc. is also in bidder's scope.
- 2) Initial charge of all lubricants & grease.
- 3) All special tools necessary for proper maintenance or adjustment of the equipment packaged in permanent box. Finish paints for touch-up painting of equipment after erection at site in sealed container.
- 4) Start-up and commissioning spares are bidder's scope of supply.

Start-up and Commissioning spares are those which would be required during equipment or system testing, start-up and commissioning. All spares used until the plant is finally handed over by the bidder to the customer come under this category. All start-up and commissioning spares as required shall be provided by the bidder without any additional cost to the BHEL and customer. Bidder to provide spares as per their system requirement without any commercial and delivery implication to BHEL/Customer during detailed engineering. List of spares shall be furnished by BIDDER along with the offer.

Bidder shall be responsible for the ready and timely availability for all the startup and commissioning spares as required during various stages of testing, cleaning and commissioning up to handing over of each unit of the total plant.

An adequate stock of start-up spares shall be available at the site such that the start-up and commissioning of the equipment/systems, Performance guarantee test and handing over the equipment/ systems to the customer will be carried out without hindrance and delay. All start-up spares which remain unused after the taking over of the plant shall remain the property of the customer.

- 5) All required elbow, tee, pipe fittings etc. required for erection of the complete system including piping shall be in bidder's scope. Bidder to provide the detailed BOQ shall be derived during detail engineering. Bidder to consider 10% margin over and above the BOQ requirement of all the fittings.
- 6) Wherever pipe racks are not available, pipes shall run on pedestals or below ground. All fixing items such as U clamps, nuts, bolts etc. required to lay the pipes on pedestals shall be in bidder's scope of work. Coating, wrapping and protection required for buried pipes shall be in bidder's scope of work.
- 7) Bidder shall consider 12 m static head + 10% margin in addition to the losses in straight pipes and bend in pipes, tees, reducer, expander and valves etc. (in yard piping) while selection of pump head during detailed engineering.
- 8) The Bidder's scope includes all the first fill and one year's topping, requirements of consumables such as greases, oils, lubricants, servo fluids/control fluids, gases, reagents, standard reference chemical solutions etc. which will be required to put the equipment covered under the scope of specifications. Consumption of all these consumables during the initial operation or PG test of bidder's supplied equipment (whichever is later) and final filling after the initial operation OR PG test of bidder's supplied equipment (whichever is later) shall also be included in the scope of the Bidder. Bidder shall also supply a quantity not less than 10% of the full charge of each variety of lubricants, servo fluids, gases, chemicals etc. used which is expected to be utilised during the first year of operation. This additional quantity shall be supplied in separate Containers. Suitable standard lubricants as available in India are desired. The variety of lubricants shall be kept to a minimum possible.

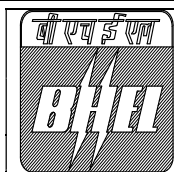
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- 9) On completion of erection, a complete list of bearings/ equipment giving their location and identification marks shall be furnished to the Owner along with lubrication requirements.
- 10) MCC, DDCMIS based control room & battery room shall be located in CPU regeneration area building. All regeneration vessels and chemical dosing facilities shall be located in CPU regeneration building. Bulk chemical storage tanks, unloading and transfer pumps shall be located open to sky. Further N-pit shall be located in open area near CPU regeneration area. CPU regeneration cum resin transfer pumps shall be located near DM water Storage tanks (inside DM Transfer Pump house) and shall have been provided with localised KNOPY arrangement on pump & motor and the same shall be in bidder's scope. Further Bidder to also provide the localized KNOPY arrangement on all pumps & motors which are open to sky.
- 11) 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.
- 12) 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.
- 13) Engineering for this project is being carried out in 3D environment at BHEL end. Name of engineering platform on which BHEL is doing the project IS Smart Plant Suite. This is being done to have automated interface checking and thereby minimising rework at site. Hence bidder, in their own interest, is requested to prepare all layout drawings using 3D Modelling software. These drawings will also be made available to BHEL in soft for checking interface with other agencies in consolidated layout drawings. Bidder's inability to prepare drawing using 3D Modelling software will not be criterion for evaluation of their bid.
- 14) Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t. existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.
- 15) Successful bidder shall furnish detailed erection manual for each of the equipment as well as complete system 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.
- 16) Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.
- 17) Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment / scope drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by vendor, BHEL reserves the right to debit cost of such rework to vendor".
- 18) Ladder & platforms shall be provided for each tank for easy accessibility & maintenance purpose by bidder.
- 19) Necessary approach (platform) shall be provided for all the Pneumatic Valves & Flow Orifice Plates.

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Necessary drawing/documents, indicating the same, shall be provided by successful bidder during contract stage.

- 20) All the transmitters (Pressure, Temperature, Flow, Level, Differential Pressure etc.) & analysers which are used in system for interlock & protection shall be redundant. For redundancy please refer the C&I portion of this specification section I-C. The same shall be indicated in P&ID by successful bidder after award of contract.
- 21) Instruments, analyzers etc. used in system should sustain operating & design parameters of system. In case operating & design parameters of instruments, analysers are less than system's parameters, then necessary arrangement/accessories shall be provided by bidder for safe operation.
- 22) Embedment plates with lugs shall also be provided by bidder as per system requirement.
- 23) All channels & brackets, mounting plates as required for mounting of motors, pumps, stirrers, tank etc. shall be in bidder's scope.
- 24) Mandatory spares as per attached Annexure-VI of Sub-Section IA to this technical specification.
- 25) All necessary structural steel for pipe supporting structure, platforms, walkways / pathways and access stairs, mechanical plant and equipment, mechanical services and pipe work associated with CPU Plant.
- 26) All Motorized valves with integral starter as per requirement and as indicated in the P&ID.
- 27) All handrails shall be of 32 mm nominal bore MS pipes (medium class) as per IS: 1161 galvanized using 750 gm/sq. m of zinc. Hand railing shall be a two-rail system with the top rail 1000 mm above the walkway surface and the intermediate rail 450 mm below the top rail. Handrail post spacing shall be limited to 1500 mm as far as possible but can be proportioned to the length of the opening. In such a case spacing shall not exceed 1850 mm centre to centre of posts. Hand railing shall be shop fabricated for specific locations and field welded or bolted to the erected structural steel. Railings shall be provided with 100 mm wide and 8 mm thick MS strip at bottom as toe guard all along the length of railing in horizontal plane. For RCC stairs, hand railing with 20 mm square MS bar balustrade with suitable MS flat and Aluminium / Teakwood handrail shall be provided, unless specifically mentioned otherwise.
- 28) Instrument hook up material shall be in bidder's scope.
- 29) Permanent ladder (not rungs) for approaching the top of tanks, valves for All steel inserts with lugs, plates, bolts, nuts, sleeves, edge angles and all other embedding components etc. as required to grout in civil works and to support/hold the equipment's being supplied under this specification for opening/maintenance purpose.
- 30) Wrapping, coating and protection of the entire buried pipe shall be as per IS 10221 or AWWA C 203-93.
- 31) Any item/work either supply of equipment or erection material which have not been specifically mentioned in but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification and shall be in bidder's scope without any commercial, technical and delivery implication to BHEL.
- 32) If service air required by the bidder in the service vessel area (for hydro-pneumatic resin transfer operation etc.) then bidder to provide necessary compressors, valves, piping, fittings, flanges, instruments etc. to meet the system requirement.
- 33) If service air required by the bidder in the CPU regeneration area (for hydro-pneumatic resin transfer operation etc.) then bidder to provide necessary compressors, valves, piping, fittings, flanges, instruments etc. to meet the system requirement.
- 34) All other items are also included in scope of supply as specified in other part of the specification.



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- 35) Space available for CPU Regeneration area (Vide ref. Dwg. No. PE-DG-417-155A-A003) are attached in Section-C1 of this specification. Bidder to accommodate their equipment within the space provided.
- 36) Bidder to submit BBU during detailed engineering after approval of Basic documents. BBU shall be equal to BOQ for the package and there shall be no price and delivery implication is applicable to BHEL / customer for the same. None of the items supplied for the project as non-billable. Incomplete BBU shall not be review by BHEL.
- 37) Bidder to take care for cooling/ lubrication of the pumps being supplied by the bidder under this technical specification. If service water pressure requirement is more than available pressure, bidder to consider suitable number of pumps for cooling for each location of 2X100% configuration for CPU package.
- 38) Any statutory requirement / clearance required for the packages from government / local body shall be in bidder's scope.
- 39) KKS codes for all drives and instruments for the project have to be followed.
- 40) KKS numbering shall be followed for all instruments/equipment's/tanks/valves/pipe etc. For maintaining plant quality standard.
- 41) The suction & discharge valves of pumps shall be provided with open & close limit switches for auto operation. All discharge valves placed at the outlet of the pumps shall be auto valves for auto operation of the plant.
- 42) Bidder to use analysis given in Sub-Section –IA ANNEXURE –VIII of this technical specification under SALIENT DESIGN INPUTS/ CRITERIA for NORMAL RUN & START-UP OR CONDENSER LEAK CONDITION for design of condensate polishing plant.
- 43) Bidder shall perform the guarantee parameters as per specification requirement to the satisfaction of owner. The exact modalities of verifying guarantee for the parameters indicated in the specification shall be finally as agreed with the owner during detailed engineering & mutually agreed.

**5.0 ELECTRIC HOIST AND MANUAL HOIST (CHAIN PULLEY BLOCK) FOR CPU PACKAGE**

Required number of electric hoist / manual hoist of adequate capacity, to meet the erection and maintenance requirements are to be provided for the various areas.

**DESIGN CRITERIA**

Selection of Electric Hoist and Manually operated Chain Pulley Blocks shall be as per following criteria

-

- (a) Electric hoist shall be provided for capacity >2T.
- (b) Chain pulley block (Manual hoist) - 500kg to <2T, wherever feasible, considering layout constraints.

Capacity of electric and manual (Chain pulley block) hoists shall be decided keeping 20% margin over equipment to be handled.

For hand operated hoists, the hoists shall be suitable for operation from floor level. Hand chain shall be provided for long travel of trolley and the Hoisting mechanism. The operator shall be able to control the movement of the electrical hoist with the help of floor operated pendant

Note:

1. Area, type, capacity mentioned are minimum requirement and shall be finalised during detail engineering without any commercial implication
2. Travel and Lift are layout dependent and shall be finalised during detail engineering without any commercial implication





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3. Additional electric/manual hoist required during detail engineering shall be provided as per design criteria given above without any commercial implication.

**SCOPE OF SUPPLIES**

2.1.0 Equipment and services to be furnished by the bidder for the ELECTRIC HOIST/ MANUAL HOIST with accessories as per the details given in the technical specification and data sheet A. Any equipment / accessories not specified in the specification but required to make the ELECTRIC HOIST/ MANUAL HOIST complete and efficient operation shall also be under the bidder's scope of work.

Compliance with this specification shall not relieve the bidder of the responsibility of furnishing material and workmanship to meet the specified working/duty conditions.

**A. Electric hoist shall include but not be limited to the following: -**

- a. Hoisting and CT drive arrangement
- b. All electrical equipment including cables (as per electrical scope matrix) and panels.
- c. PVC insulated shrouded bus bar DSL
- d. Earthing arrangement.
- e. Initial fill of lubricant.
- f. Painting of electric hoist and accessories.
- g. Maintenance tools & Tackle
- h. Erection & Commissioning spares
- i. Power cable from isolator switch to DSL
- j. Isolating switch in enclosure at operating floor for disconnecting supply to DSL while maintaining the electric hoist.
- k. Mandatory spares

**B. Manual hoist shall include but not be limited to the following:**

- a. Chain pulley blocks with/without traveling trolleys
- b. Maintenance Tools and Tackles
- c. Painting

**2.2.0 Erection and Commissioning spares (ELECTRIC HOIST)**

The Bidder shall also supply erection & commissioning spares along with his main equipment as per his experience, for replacement of damaged or unserviceable parts during the execution of the project at site, to avoid delay in the project schedule. This shall form part of the main equipment supply. The Purchaser shall retain the unutilized commissioning spares. The initial fill of lubricants, oil etc. shall also be supplied by the bidder.

2.3.0 Services to be provided by the bidder Packing, forwarding and transportation to site, storage and handling at site.

2.4.0 Erection and Commissioning

2.5.0 Functional test (Overload testing, load testing at rated speed, travel and hoisting motion checks as per relevant design standards)

2.6.0 Obtaining clearance and acceptance certificate from the concerned competent authority after site test as applicable. Necessary fees/expenditure as required shall be borne by the supplier.

**3.0 Inspection and Testing**

As per quality plan approved during detail engineering. Prime inspection agency shall be BHEL. Equipment supplied shall be strictly in accordance with nomenclature & technical specification.

**4.0 Runway beam**

Shall be supplied by civil contractor.



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## 5.0 **PAINTING SPECIFICATION**

Painting of the equipment shall be carried out to protect the same from rusting / corrosion during shipping, long storage at site, erection, and during its normal operation / usage.

Whilst the essential requirements of surface preparation and painting are specified here, these in no way relieve the contractor of his responsibility to carry out his work in accordance with good practices. However, any deviation/modification from the specification shall be referred to the purchaser for approval.

Surface preparation: De greasing and Mechanical cleaning with wire brush or hand tool. (SA 1/ ST 2 / ST 3 as applicable)

Primer : Red oxide Zinc chromate as per IS: 2074 (Alkyd medium) - 1 coat, DFT 35μ per coat.

Intermediate: Red oxide Zinc chromate as per IS: 2074 (Alkyd medium) - 1 coat, DFT 35μ per coat.

Finish Coat : Synthetic enamel (Alkyd medium) as per IS: 2932- 2 coats, DFT 25 μ per coat.

Total DFT : 120μ

### **Electrical /Control Panel:**

Surface preparation: Seven tank process

Primer : Zinc phosphate (Alkyd medium) - 2 coat, Minimum DFT 25- 35 μ per coat.

Finish Coat : Synthetic enamel (Alkyd medium) as per IS: 2932- 3 coats, Minimum DFT 20- 25 μ per coat.

Total DFT : 110 - 145μ

### **Color Shade:**

| SL. No | Item Description      | Color Shade                         | Remarks                            |
|--------|-----------------------|-------------------------------------|------------------------------------|
| 1      | Crane Structure       | Smoke Gray shade 692 as per IS-5    |                                    |
| 2      | Bottom block assembly | Smoke Gray shade 692 as per IS-5    |                                    |
| 3      | Hooks                 | Lemon yellow, shade 356 as per IS-5 | With 100 mm wide black zebra strip |
| 4      | End carriage sweep    | Smoke Gray shade 692 as per IS-5    |                                    |
| 5      | Motors                | Smoke Gray shade 692 as per IS-5    |                                    |
| 6      | Control Panels        | Smoke Gray shade 692 as per IS-5    |                                    |

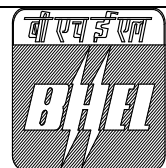
## 6.0 **PACKING**

As per packing details specified elsewhere in specification.

## 7.0 **DEMONSTRATION TEST**

Hoist along with its drives, controls and other accessories shall be demonstrated for the rated capacity against the rated speed of motions and for the service conditions specified as specified in QAP and as per IS 3938 for electric hoist and IS 3832 for manual hoist.

The bidder shall have the full responsibility for the safe and efficient operation of the hoist with associated accessories as a single unit.



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If the shop performance tests indicate the failure of any of the components to achieve the guaranteed performance, the deficiency shall be made good at bidder's cost.

Demonstration tests shall be carried out each time after the rectification /modification is carried out.

## **8.0 MAKE OF SUB - VENDOR ITEMS**

Makes of bought out items will be as per list specified in the specification. No other make will be acceptable, until and unless specifically got it approved by the purchaser/ end client.

## **9.0 TESTING AT SITE**

### **A) ELECTRIC HOIST:**

As required for statutory clearance for operating at site i.e., overload test, load test and other tests as per IS 3938.

Test for Operation -After the supply has been connected, tests shall be carried out to prove the following:

- The satisfactory operation of each controller, switch, contactor, relay and other control devices and in particular the correct operation of all limit switches under the most unfavourable conditions;
- The correctness of all circuits and interlocks and sequence of operation; and
- The satisfactory operation of all protective devices.

Overload Test -After test but before the hoist is put into service, it shall be tested with overload relays appropriately set, to lift and sustain a test load of 125 percent of the working load. During the overload test, the hoist shall sustain the load under full control. The specified speeds need not be attained but the hoist shall show itself capable of dealing with the overload without difficulty.

### **B) MANUAL HOIST:**

As required for statutory clearance for operating at site with following minimum test i.e., overload and load test.

## **10.0 TECHNICAL DATA SHEET:**

### **A) ELECTRIC HOIST:**

| S.No. | DESCRIPTION                       | TECHNICAL PARTICULARS                                       |
|-------|-----------------------------------|-------------------------------------------------------------|
| 1.0   | <b>Type</b>                       | Electric wire rope hoist with electrically operated trolley |
| 2.0   | <b>Overload test</b>              | 125% of SWL                                                 |
| 3.0   | <b>Design Ambient temperature</b> | 50 deg C                                                    |
| 4.0   | <b>General Design</b>             | As per IS: 3938, class-II                                   |
| 5.0   | <b>Operating speed</b>            | Full speed (m/min)                                          |
| 5.1   | Hoisting speed                    | 3.0 M / min.                                                |
| 5.2   | Trolley speed                     | 15.0 M / min.                                               |
| 6.0   | <b>Type of transmission</b>       | Through Electric motor and gearbox                          |



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|      |                                |                                                                             |
|------|--------------------------------|-----------------------------------------------------------------------------|
| 7.0  | <b>Wire Rope</b>               | RHO lay construction                                                        |
| 7.1  | Construction / core            | 6 x 36/ 6 x 37 Steel/Fiber core                                             |
| 7.2  | Strength                       | 1770 or 1960 N/m2 as per IS:2266                                            |
| 7.3  | Code                           | IS:2266                                                                     |
| 7.4  | Material                       | Plough steel                                                                |
| 7.5  | Factor of safety               | 5 as per IS:3938                                                            |
| 8.0  | <b>Load Hook and block</b>     |                                                                             |
| 8.1  | Type of load hook              | Forged steel to IS 15560- C shank, swiveling type with safety latch and pin |
| 8.2  | Load hook Code                 | IS:15560                                                                    |
| 8.3  | Load hook Material             | As per IS: 15560                                                            |
| 8.4  | Hook suspension                | Thrust bearing                                                              |
| 9.0  | <b>Gear (Hoisting)</b>         |                                                                             |
| 9.1  | Type                           | Spur / Helical                                                              |
| 9.2  | Material                       | As per IS 3938                                                              |
| 9.3  | Bearing type                   | Antifriction Ball / Roller                                                  |
| 10.0 | Trolley drive                  |                                                                             |
| 10.1 | <b>Wheel</b>                   | Single flange taper thread                                                  |
| 10.2 | Wheel conform to (Std. / code) | IS: 3938                                                                    |
| 10.3 | Wheel material                 | Cast steel/ forged steel as per IS 3938                                     |
| 10.4 | Bearing type                   | Antifriction Ball / Roller                                                  |
| 11.0 | <b>SHEAVE</b>                  |                                                                             |
| 11.1 | Material                       | Fabricated from steel plate. IS: 2062 Gr. A or B as per IS: 3938            |
| 11.2 | Bearing type                   | Antifriction Ball / Roller                                                  |
| 12.0 | <b>BRAKE (Hoist)</b>           |                                                                             |
| 12.1 | Type                           | DCEM brakes                                                                 |
| 12.2 | Capacity                       | 150 % of FLT                                                                |
| 12.3 | Number                         | One number for each motor                                                   |
| 13.0 | <b>BRAKE (Trolley)</b>         |                                                                             |
| 13.1 | Type                           | DCEM brakes                                                                 |



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|      |                                             |                                                                                                                                                         |               |
|------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|
| 13.2 | Capacity                                    | 125 % of FLT                                                                                                                                            |               |
| 13.3 | Number                                      | One number for each motor                                                                                                                               |               |
| 14.0 | <b>ROPE DRUM</b>                            |                                                                                                                                                         |               |
| 14.1 | Material                                    | Rolled steel, welded construction / seamless pipe as per ASTM A106 / 53 GR A/B                                                                          |               |
| 14.2 | Type of groove                              | Right hand groove or Right hand and left hand groove                                                                                                    |               |
| 15.0 | <b>TYPE OF DSL</b>                          |                                                                                                                                                         |               |
| 15.1 | Travel                                      | PVC shrouded bus bar                                                                                                                                    |               |
| 16.0 | <b>MOTORS</b> (for hoisting and trolley)    |                                                                                                                                                         |               |
| 16.1 | Type                                        | Sq. Cage induction, TEFC, S4 duty, 40% CDF                                                                                                              |               |
| 16.2 | Number of start                             | 150 starts / hr                                                                                                                                         |               |
| 16.3 | Voltage, Phase and Frequency                | 415V $\pm$ 10%, 3 phase, 4 wire, 50 Hz, $\pm$ 5 %                                                                                                       |               |
| 16.4 | Class of insulation                         | Class "F" and temperature rise limited to class "B".                                                                                                    |               |
| 16.5 | Type of enclosure                           | TEFC                                                                                                                                                    |               |
| 16.6 | Degree of protection provided for enclosure | IP-55                                                                                                                                                   |               |
| 16.7 | Margin                                      | Motor rating shall be calculated keeping margin of at least 15% over the maximum power requirement in the duty condition specified.                     |               |
| 17.0 | <b>LIMIT SWITCHES</b>                       | Hoisting                                                                                                                                                | Trolley       |
| 17.1 | Type                                        | Snap action                                                                                                                                             | two way lever |
| 18.0 | <b>Pendent Push Buttons</b>                 | Up/ down/ forward/ reverse push button with indicating lamps                                                                                            |               |
| 18.1 | <b>Emergency stop push button</b>           | Provided. (Mushroom head)                                                                                                                               |               |
| 19.0 | <b>Power cable &amp; Control Cable</b>      | All cabling shall be XLPE insulated fire resistant (FRLS) cables.                                                                                       |               |
| 20.0 | <b>Control Voltage</b>                      | 110 V (shall be provided through suitable rated 415/110V control transformer).                                                                          |               |
| 21.0 | <b>Painting</b>                             | Shall be submitted as separate document in line with KTPS (Stage - VII) during detail engineering. Color Shade from the same is being reproduced below: |               |



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| SL. No | Item Description      | Color Shade                         | Remarks                            |
|--------|-----------------------|-------------------------------------|------------------------------------|
| 1      | Crane Structure       | Smoke Gray shade 692 as per IS-5    |                                    |
| 2      | Bottom block assembly | Smoke Gray shade 692 as per IS-5    |                                    |
| 3      | Hooks                 | Lemon yellow, shade 356 as per IS-5 | With 100 mm wide black zebra strip |
| 4      | End carriage sweep    | Smoke Gray shade 692 as per IS-5    |                                    |
| 5      | Motors                | Smoke Gray shade 692 as per IS-5    |                                    |
| 6      | Control Panels        | Smoke Gray shade 692 as per IS-5    |                                    |

**B) MANUAL HOIST (CHAIN PULLEY BLOCK):**

|            |                                      |                                           |
|------------|--------------------------------------|-------------------------------------------|
| <b>1.0</b> | <b>Type</b>                          | Chain pulley block with/without trolley   |
| <b>2.0</b> | <b>General Design</b>                | IS: 3832                                  |
| <b>3.0</b> | <b>Duty Class as per IS:3832</b>     | Class –II                                 |
| <b>4.0</b> | <b>Hoisting Mechanism</b>            |                                           |
| a)         | Type                                 | Hand operated gear transmission           |
| b)         | Type of gear                         | Spur / Helical                            |
| c)         | Load Chain                           |                                           |
| i)         | Type                                 | Link type                                 |
| ii)        | Material                             | T (8) as per IS: 6216                     |
| iii)       | Conforms to (Std./Code)              | IS: 6216                                  |
| d)         | Hand Chain                           |                                           |
| i)         | Type                                 | Link type                                 |
| ii)        | Material                             | Mild steel Grade 30                       |
| iii)       | Conform to Std.                      | IS:2429 (Part I)                          |
| e)         | Load Hook & Hook Block               |                                           |
| i)         | Type of load hook                    | Plain shank- Trapezoidal section          |
| ii)        | Load hooks conforms to               | IS: 15560                                 |
| iii)       | Type of hook suspension              | Swivelling type with lock                 |
| iv)        | Type of make of bearing              | Thrust ball bearing of hook suspension    |
| v)         | Type & Material of hook              | As per IS 15560                           |
| f)         | Gears/ Pinion                        |                                           |
| i)         | Type                                 | Spur                                      |
| ii)        | Material                             | Alloy steel / carbon steel as per IS 3938 |
|            | Type of Bearing                      | Antifriction ball bearing / Roller        |
| g)         | Sprockets :<br>Type of bearings used | Antifriction ball bearing / Roller        |
| h)         | Method of lubrication                |                                           |
|            | Bearings                             | Grease                                    |
|            | Gearing & Pinions                    | Grease                                    |
|            | Sprocket                             | Grease                                    |



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|            |                                 |                                   |
|------------|---------------------------------|-----------------------------------|
| i)         | Brakes<br>Type                  | Screw and friction disc type      |
| <b>5.0</b> | <b>Trolley and Bridge drive</b> |                                   |
| a)         | Trolley                         |                                   |
| i)         | Type                            | Geared (Manually operated)        |
| ii)        | Material of frame               | Mild steel (IS:2062 Grade A or B) |
| b)         | Drive Chain                     |                                   |
| i)         | Type                            | Link type                         |
| ii)        | Material                        | Steel Gr.30                       |
| c)         | Wheel                           |                                   |
| i)         | Number of pairs of wheel        | Two in each trolley/bridge        |
| ii)        | Flange                          | Single flanged                    |
| iii)       | Type of bearings need           | Antifriction                      |
| iv)        | Wheel material                  | Cast steel                        |
| d)         | Gears                           |                                   |
| i)         | Type                            | Spur / helical                    |
| ii)        | Material                        | EN8                               |
| iii)       | Type of bearings used           | Antifriction                      |
| e)         | Method of lubrication for       |                                   |
| i)         | Bearings                        | Grease                            |
| ii)        | General                         | Grease                            |
| iii)       | Sprockets                       | Grease                            |
| <b>6.0</b> | <b>Painting</b>                 | As per manufacturer's standard    |

### **11.0 Maintenance Tools and Tackles**

One (1) complete unused new set of special purpose tools, tackles and accessories along with detailed instructions and maintenance manual shall be supplied. Tools shall be of suitable sizes for maintenance of electric hoist of each type and capacity. Each tool and wrench shall be stamped so as to be identified easy for its use. The tools shall be supplied in steel toolbox and with a copy of instruction manual. The items supplied shall be of the best quality, specially protected against rusting. The following shall be provided as minimum requirement:

| S. No. | Description                                                   | Qty   |
|--------|---------------------------------------------------------------|-------|
| 1      | Complete set of ring spanners (Indicate the sizes offered)    | 1 Set |
| 2      | Complete set of screwdrivers (Min. 6 nos. Indicate the sizes) | 1 Set |
| 3      | Adjustable Spanner                                            | 1 No. |
| 4      | Insulated pliers                                              | 1 No. |
| 5      | Wrench spanner                                                | 1 No. |
| 6      | Grease Gun                                                    | 1 No. |
| 7      | Oil Gun                                                       | 1 No. |
| 8      | Hand Lamp                                                     | 1 No. |
| 9      | Line tester                                                   | 1 No. |

Note: -The tools shall be supplied in one tool box. Bidder shall ensure that the tools & tackles mentioned in above list are sufficient to handle all sizes/capacities of hoists & in case any other /additional tool is required for handling/maintenance any size/capacity of hoist the same shall be included in this list.



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## **12.0 DRAWING/DOCUMENT SUBMISSION**

The successful bidder shall submit the following drawings / documents during detail engineering for customer's approval /information:

### **A) ELECTRIC HOIST**

| SI. No. | BHEL DRG.NO        | DRAWING TITLE                                                                         |
|---------|--------------------|---------------------------------------------------------------------------------------|
| 1       | PE-V1-417-155-A100 | Manufacturing Quality Plan with Sub vendor list                                       |
| 2       | PE-V1-417-155-A101 | GA Drawing & Tech. Datasheet for Electric Hoist, DSL arrangement and painting details |
| 3       | PE-V1-417-155-A102 | Schematic Circuit Diagram for electric hoist                                          |
| 4       | PE-V1-417-155-A103 | Mechanism Sizing Calculation                                                          |
| 5       | PE-V1-417-155-A105 | O & M Manual including erection procedure                                             |

### **B) MANUAL HOIST (CHAIN PULLEY BLOCK):**

| SI. No. | BHEL DRG.NO        | DRAWING TITLE                                                              |
|---------|--------------------|----------------------------------------------------------------------------|
| 1       | PE-V1-417-155-A200 | Manufacturing Quality Plan                                                 |
| 2       | PE-V1-417-155-A201 | GA Drawing & Tech. Datasheet for CPB with detail BOM with painting details |
| 3       | PE-V1-417-155-A202 | O & M Manual including erection procedure                                  |

#### **Notes:**

1. The above drawing list is tentative and shall be finalized with the successful bidder after placement of order. While some of the drawings indicated above may not be applicable, some additional drawings may also be required based on scope of work.
2. Drawings shall be prepared in Auto-Cad latest edition. Required no. of hard and soft copies (editable) of the drawings shall be furnished as per requirement specified elsewhere in the specification.
3. Only manual calculation with authentic supporting literature (e.g. extracts of hand Book/ standard/codes) shall be acceptable. All design calculations and drawings shall be in SI system only.
4. Detailed list/ break-up of mandatory spares shall be submitted along with BBU by supplier for approval during engineering.
5. Bidder to note that all values/dimensions/elevations etc. without supporting back up data adopted/assumed by the successful bidder (during contract stage) in the design calculation/drawings shall be taken by the customer/owner to be correct unless they are stipulated in the specification. Any problem arising later in this regard shall be made good by the successful bidder at his cost and no extension of time shall be granted for the same.
6. All the drawings and documents including general arrangement drawing, data sheet, calculation etc. to be furnished to the customer during detailed engineering stage shall include / indicate the following details for clarity w.r.t. Inspection, construction, erection and maintenance etc.:
  - a) All drawings and documents shall indicate the list of all reference drawings including general arrangement.
  - b) All drawings shall include / show plan, elevation, side view, cross - section, skin section, blow - up view; all major self-manufactured and bought out items shall be labeled and included in BOQ / BOM in tabular form.
  - c) Painting schedule shall also be made as a part of general arrangement drawing of each equipment / items indicating at least 3 trade names.
  - d) All the drawings required to be furnished to customer during detailed engineering stage shall include technical parameters, details of paints and lubrication, hardness and BOQ / BOM in tabular form indicating all major components including bought out items and their





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quantity, material of construction indicating its applicable code / standard, weight, make etc.

- e) Drawings/ documents to be submitted for purchasers review/ approval shall be under Revision A, B, C... etc. while drawings /documents to be submitted thereafter for customer's approval after purchaser's approval shall be under R-0, 1, 2, 3 ....etc.
- f) Drawings and documents not covered above but required to check safety of machines/ system, shall be submitted during detailed engineering stage without any commercial implication.
- g) All drawings shall include "B.O.M" and indicate quantity, material of construction, make along with IS/BS No., Technical parameters, dimensions, hardness, machining symbol and tolerance, requirement of radiography and hydraulic tests, painting details, elevation, side view, plan, skin section and blow-up view for clarity.
- h) All drawings shall be prepared as per BHEL's title block and shall bear BHEL's drawing No.
- i) 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.
- j) Bidder to follow the following the drawing submission schedule:
  - i. 1st submission of drawings from date of LOI as per the submission schedule.
  - ii. Every revised submission incorporating comments – within 7 days.
- k) Bidder to submit revised drawings complete in all respects incorporating all comments. Any incomplete drawing submitted shall be treated as non-submission with delays attributable to bidder's account. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.
- l) Manufacturing shall be started on receipt of cat II approved drawings.

## **8.0 SCOPE OF SUPPLY (ELECTRICAL)**

Complete electrical as per specification / details indicated in Sub-Section IB (Specific Technical Requirement Electrical) and IIB (General Technical Requirement Electrical).

## **9.0 SCOPE OF SUPPLY (C&I)**

Complete C&I as per specification / details indicated in Sub-Section IC (Specific Technical Requirement C&I) and IIC (General Technical Requirement C&I).

## **10.0 SCOPE OF SUPPLY (CIVIL)**

Total Civil is in BHEL's Scope of work, however complete grouting for equipments, fixing and any concreting inside the vessels, puddle pipe inside civil structure, nozzles, supporting plate/ structures & lining shall be in bidder's scope.

Also detailed Civil Input drawing shall be provided by bidder. Successful bidder shall furnish civil assignment drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder and shall be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by vendor, BHEL reserves the right to debit cost of such rework to vendor".

## **11.0 SCOPE OF SERVICES**

The bidder's scope also includes following services for scope under this specification:

- (i) Erection and commissioning, unloading, storage and handling at site.
- (ii) Minor civil work like chipping of foundation, grouting below base plate for all structures, equipment, grouting of anchor bolts wherever these are not placed in the foundation during casting of foundation



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itself, excavation & filling of earth for buried pipes if and as required. To the extent possible, vendor shall ensure to supply all foundation bolts timely so as to facilitate placement of these bolts while casting the foundation. Wrapping, coating and protection of all the buried pipe shall be as per IS 10221.

- (iii) Pre-commissioning work such as flushing, hydraulic testing etc. Necessary consumables and instrumentation as required for inspection and testing at works as well as at site including pre-commissioning activities shall be arranged by the successful bidder at their own cost.
- (iv) Arrangement of all instruments, equipments, lab facilities, reagents, monitoring gadgets for monitoring, pre-commissioning, carrying out trial run, commissioning, PG test & till plant hand over.
- (v) Monitoring gadgets, instruments and equipments required for maintenance.
- (vi) During Logic preparation, FAT & commissioning of DDCMIS, bidder shall arrange his concerned personnel at PEM office, BHEL –EDN office & for commissioning of DDCMIS at site, as and when required by customer / BHEL without any delay as per clause specified under Sub -section-IC (C&I).
- (vii) Complete grouting for equipment, fixing and any concreting inside the vessels and lining.
- (viii) All personnel required during maintenance, Commissioning, trial run and PG test.
- (ix) Trial run for requisite period.
- (x) Performance Guarantee testing.
- (xi) Training of plant Owner's personnel, O&M operators' personnel on plant operation and maintenance.
- (xii) All other facilities/ services as described in section on site services in specification and related to CPU Plant scope of work.
- (xiii) Relevant requirements as per GTR, GCC, ECC & SCC.
- (xiv) All the Piping, Valves and Equipment's of this system shall be protected against external corrosion by providing suitable painting. The surfaces of stainless steel, Gunmetal, brass, bronze and non-metallic components shall not be applied with any painting. The condensate pipelines and valves near the condensate polisher vessels shall be painted as per Sub-Section IA ANNEXURE V of this Technical Specification.
- (xv) Painting shall be as specified Sub-Section IA ANNEXURE V of this technical specification. However, any variation in the painting schedule as finally approved by BHEL / Customer shall be taken care by the bidder without any commercial and delivery implication to BHEL / Customer. Colour coding scheme shall be intimated to vendor during detail engineering.
- (xvi) Final touch up paint at site.

## **12.0 TERMINAL POINTS**

### **12.1 CONDENSATE POLISHING PLANT - SERVICE VESSEL AREA**

- (i) Service vessel inlet – (OD 457.2 X 12.7 mm thick, SA 106 Gr-C) - Single piping connection near service vessel area in BC bay for unit 1, unit -2, unit -3, unit -4 & unit -5 as per attached Composite Piping Layout Plan Below Mezzanine Floor Dwg. No. PE-DG-417-100-M032.
- (ii) Service vessel outlet – (OD 457.2 X 12.7 mm thick, SA 106 Gr-C) - Single piping connection near service vessel area in BC bay for unit 1, unit -2, unit -3, unit -4 & unit -5 as per attached Composite Piping Layout Plan Below Mezzanine Floor Dwg. No. PE-DG-417-100-M032.



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- (iii) Rinse water outlet- Rinse water outlet piping (OD 168.3 x 7.11 mm, SA 106 Gr-B) from the service vessel outlet till condenser hot well for each TG unit is in the scope of bidder.
- (iv) The DM water used for resin transfer operations from the Regeneration building to the Condensate Polisher vessels shall be terminated by the bidder to the nearest drain trench through drain channel.
- (v) 25 NB connection of Instrument air supply at 5 to 7 kg/cm<sup>2</sup> (g) – At 5-meter distance from service vessel area for each TG unit. However, distribution and piping inside each TG hall service vessel area shall be in bidder's scope.
- (vi) Gland sealing valves cooling water supply & analysers rack cooling water supply piping – Service water connection (25 NB) at 5-meter distance from service vessel area for each TG unit. Piping inside service vessel area for each TG unit for mentioned services will be in bidder's scope.

## **12.2 EXTERNAL REGENERATION AREA**

- (i) DM Water Supply –The DM water piping terminal point shall be common outlet line from all 5 DM water storage tanks (DM water storage tanks not in bidder's scope) & for recirculation line terminal point shall be up to common DM water recirculation line to all 5 DM water storage tanks at a distance of 10 m from the DM water transfer pump house. Piping from these terminal points to the pump suction of 1<sup>st</sup> & 2<sup>nd</sup> stage of CPU regeneration cum resin transfer pumps shall be in the scope of bidder. Approximate piping distance for the same shall be considered as 25 m for each stage pump suction line.
- (ii) CPU regeneration cum resin transfer pumps Recirculation Lines – Piping from 1<sup>st</sup> stage & 2<sup>nd</sup> stage CPU regeneration cum resin transfer pumps outlet lines to all 5 DM water storage tanks common recirculation line up to terminal point shall also be in the scope of bidder. Approximate piping distance for the same shall be considered as 25 m for each stage pump recirculation line.
- (iii) 50 NB Instrument air supply at 5 to 7 kg/cm<sup>2</sup> (g) – At 5-meter distance from the CPU regeneration building.
- (iv) Service water (50 NB) - At 5-meter distance from the CPU regeneration building. However, distribution and piping inside CPU regeneration area will be in bidder's scope.
- (v) Drinking/Potable water (50NB) - At 5-meter distance from the CPU regeneration building. However, distribution and piping inside CPU regeneration area will be in bidder's scope.
- (vi) N-Pit effluent piping (150 NB) from N Pit up to CMB OF ETP shall be in bidder's scope. The piping distance to be considered from 1<sup>st</sup> set of regeneration system N-pit to CMB of ETP shall be 1500 m. Similarly, the piping distance to be considered from 2<sup>nd</sup> of regeneration system N-pit to CMB of ETP shall be 1500 m.
- (vii) In addition to that detailed terminal points shall be as per the P&ID for CPU plant (BHEL Drg. No.: PE-DG-412-155A-A001) enclosed with the technical specification.

## **13.0 EXCLUSIONS**

- 13.1 All civil works including foundation of equipment. However complete grouting for equipment, fixing and any concreting inside vessels and lining shall be in the scope of the bidder. But civil works including operating / maintenance platforms and interconnection platforms (if any) with ladders / stairs & handrails, structural supports and hangers for pipes / cables / ducts, crane rails, all embedments and inserts with lugs including anchor fasteners, bolts etc., dressing of foundations, grouting of pockets and underpinning of base plates for equipment / structures and fixing supports, filling and finishing of openings in walls, floors, cladding, roof and trenches shall be in Bidder's scope.



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**13.2** Main pipe trestles interconnecting CPU regeneration building and Service vessel Pipe trestle. However, auxiliary structure, hanger/support components for all the piping (CPU regeneration area, in acid/alkali handling area, interconnecting acid/alkali storage area, CPU service vessels, DM water piping, resin transfer piping, instrument air piping, service water piping, potable water piping and effluent disposal piping etc.) are in bidder's scope.

**13.3** Instrument air up to terminal points.

**13.4** All chemicals except reagents, monitoring gadgets required for pre- commissioning, commissioning, trial run and PG test.

**13.5** Air conditioning, ventilation & firefighting facilities.

**13.6** Supply of ISMB monorail.

**13.7** Other exclusions are mentioned in the electrical & C&I parts of this specification.

**13.8** Service water, Drinking/ potable water & DM water up to terminal points.

**14.0 QP AND SUB VENDOR APPROVAL**

**14.1** Minimum QP requirements are specified as Sub-Section IA ANNEXURE I. BHEL & customer reserves the right for inspection of imported items by BHEL/customer officials (if felt necessary). The same shall be decided during detail engineering during approval of QP's.

**14.2** However, any additional comments as given by BHEL/Customer on quality plan shall be adhered by the bidder without any commercial & delivery implication to BHEL.

**14.3** Requirement of detailed QP, inspection checklist, certificate of conformance etc. for each equipment and sub-vendor shall be finalized during detailed engineering stage; decision of BHEL/customer shall be binding on vendor in this regard. Any changes/additional tests insisted upon by Owner during approval of QAP's shall be accepted by bidder without any commercial and delivery implication to BHEL/Customer. Bidder shall submit the quality plans in BHEL format during detailed engineering stage. Bidder to note further that during detailed engineering all the QAP's/check lists etc. shall be submitted to Customer/BHEL for approval. All inspection & testing etc. shall be carried out accordingly.

**14.4** List of make sub vendor items is enclosed as Sub-Section IA ANNEXURE-II is indicative only and is subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL. Any additional sub vendor shall be subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

**14.5** Bidder to propose sub vendor list with following back up documents within 4 weeks of placement of LOI/LOA. Thereafter no request for additional sub-vendor shall be entertained. The sub vendor list shall subject to BHEL and Customer approval during detailed engineering stage without any commercial & delivery implication to BHEL.

**14.6** Dealers are not acceptable for any item of the package. Bidder shall procure all items including plates, structural, flanges; counter flanges etc. from approved sub vendor only.

**15.0 FUNCTIONAL GUARANTEES AND LIQUIDATED DAMAGES**

Functional Guarantees and liquidated damages shall be as per enclosed Sub-Section IA ANNEXURE III.

**16.0 DESIGN/ CONSTRUCTION**

In addition to the requirements of Sub-Section IIB, IIC the following shall also be complied under scope of this specification.



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The P&I diagram is enclosed herein in this section for bidder's compliance.

The material of construction specified in data sheet-A are minimum requirements and material of construction for other components not specified shall be similarly selected by the bidder for intended duty which shall be subject to BHEL / Customer approval during detail engineering without any commercial & delivery implication to BHEL.

## 17.0 DRAWING/DOCUMENTS REQUIREMENT

After award of LOI, 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.

The number of drawing/documents to be submitted by the bidder shall be as per enclosed Sub-Section IA ANNEXURE IV. The submission of soft copy or hard copy of the document whichever is later will be considered as final date of submission of the document. The 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. Bidder to comply with the observations of the BHEL and CUSTOMER without price & delivery implication.

For the Drawings/Documents distribution Procedure, please refer attached Sub-Section IA Annexure-IV. 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 numbers of soft copies & hard copies of drawing/documents to be submitted by the bidder shall be as per enclosed Sub-Section IA Annexure-IV.

After award of LOI/LOA, drawing/documents to be submitted by the bidder for BHEL/Customer approval has been indicated in Sub-Section IA Annexure VII. However, any additional drawing /document if found necessary for completion of the engineering, the same shall be submitted by bidder without any technical, commercial & delivery implication to BHEL. Bidder confirmed drawings submission schedule as follows:

- a. Drawing/documents submission schedule: First submission of basic drawings/ documents – (Please refer MDL for list of basic drawing/documents & submission schedule).
- b. Every revised document shall be submitted by bidder incorporating BHEL/customer comments – within 10 days.

Bidder further confirmed 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. For any clarification/ discussion required to complete the drawings, the bidder shall himself depute his personal to BHEL for across the table discussions/ finalizations/ submissions of drawings.

- (a) List and schedule of drawings/documents to be submitted after award of contract: -

| MASTER DRAWING LIST(MDL) |                      |                                                        |                                                                   |                         |
|--------------------------|----------------------|--------------------------------------------------------|-------------------------------------------------------------------|-------------------------|
| Sr.No.                   | Drawing/Document No. | Drawing/Document Title                                 | No. of weeks for drawing/document submission after placing LOI/PO | Paper Size of Dwg/Docs. |
| 1.0                      | PE-V0-417-155-A001   | QAP FOR PRESSURE VESSELS FOR CONDENSATE POLISHING UNIT | 10                                                                | A4                      |



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| 2.0  | PE-V0-417-155-A002   | QAP FOR SERVICE VESSEL FOR CONDENSATE POLISHING UNIT                                                | 10 | A4 |
| 3.0  | PE-V0-417-155-A003   | QAP FOR ATMOSPHERIC TANKS FOR CONDENSATE POLISHING UNIT                                             | 10 | A4 |
| 4.0  | PE-V0-417-155-A004   | QAP FOR BLOWERS WITH MOTOR FOR CONDENSATE POLISHING UNIT                                            | 10 | A4 |
| 5.0  | PE-V0-417-155-A005   | QAP FOR METERING PUMPS WITH MOTOR FOR CONDENSATE POLISHING UNIT                                     | 10 | A4 |
| 6.0  | PE-V0-417-155-A006   | QAP FOR HORIZONTAL / VERTICAL CENTRIFUGALPUMPS WITH MOTOR FOR CONDENSATE POLISHING UNIT             | 10 | A4 |
| 7.0  | PE-V0-417-155-A008   | QAP FOR VALVES FOR CONDENSATE POLISHING UNIT                                                        | 10 | A4 |
| 8.0  | PE-V0-417-155-A009 * | OPERATION & CONTROL PHILOSOPHY FOR CPU ALONG WITH CONTROL SYSTEM CONFIGURATION DIAGRAM              | 6  | A4 |
| 9.0  | PE-V0-417-155-A010 * | PROCESS DESIGN & SIZING CALCULATIONS, DS OF RESIN, VESSEL THICKNESS & PR. DROP CALCULATIONS FOR CPU | 4  | A4 |
| 10.0 | PE-V0-417-155-A011   | TECHNICAL DATA SHEET FOR HEATER FOR CONDENSATE POLISHING UNIT                                       | 10 | A4 |
| 11.0 | PE-V0-417-155-A012   | TECHNICAL DATA SHEET OF BLOWERS FOR CONDENSATE POLISHING UNIT                                       | 10 | A4 |
| 12.0 | PE-V0-417-155-A013   | TECHNICAL DATA SHEET FOR MOTOR FOR CONDENSATE POLISHING UNIT                                        | 10 | A4 |
| 13.0 | PE-V0-417-155-A014   | TECHNICAL DATA SHEET FOR ANALYSERS FOR CONDENSATE POLISHING UNIT                                    | 10 | A4 |
| 14.0 | PE-V0-417-155-A015   | TECHNICAL DATA SHEET FOR HIGH PRESSURE VALVES FOR CONDENSATE POLISHING UNIT                         | 10 | A4 |
| 15.0 | PE-V0-417-155-A017   | PAINTING SCHEDULE FOR CPU                                                                           | 10 | A4 |
| 16.0 | PE-V0-417-155-A018   | TECHNICAL DATA SHEET FOR METERING PUMPS FOR CONDENSATE POLISHING UNIT                               | 10 | A4 |
| 17.0 | PE-V0-417-155-A019   | DATASHEET OF RESIN TRAP, CARBON TRAP, ACF, AGITATOR FOR CONDENSATE POLISHING UNIT                   | 12 | A4 |
| 18.0 | PE-V0-417-155-A020   | TECHNICAL DATA SHEET FOR INSTRUMENTS FOR CONDENSATE POLISHING UNIT                                  | 10 | A4 |
| 19.0 | PE-V0-417-155-A021   | TECHNICAL DATA SHEET OF HORIZONTAL / VERTICAL CENTRIFUGALPUMPS FOR CONDENSATE POLISHING UNIT        | 10 | A4 |
| 20.0 | PE-V0-417-155-A022   | TECHNICAL DATA SHEET FOR LOW PRESSURE VALVES FOR CONDENSATE POLISHING UNIT                          | 10 | A4 |
| 21.0 | PE-V0-417-155-A023   | QAP / ICL FOR CPU (FOR BALANCE OF ITEMS)                                                            | 12 | A4 |
| 22.0 | PE-V0-417-155-A024   | ELECTRICAL LOAD DATA FOR CONDENSATE POLISHING UNIT                                                  | 10 | A4 |
| 23.0 | PE-V0-417-155-A025   | GA DRAWING OF SERVICE VESSELS FOR CPU                                                               | 10 | A1 |
| 24.0 | PE-V0-417-155-A026   | GA DRAWING OF PRESSURE VESSELS FOR CPU                                                              | 10 | A1 |



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| 25.0 | PE-V0-417-155-A027   | GA DRAWING OF ATMOSPHERIC TANKS FOR CPU                                                      | 10 | A1 |
| 26.0 | PE-V0-417-155-A028   | CONTROL SCHEME FOR CONDENSATE POLISHING UNIT                                                 | 14 | A4 |
| 27.0 | PE-V0-417-155-A029   | CIVIL ASSIGNMENT DRAWING OF CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA)                  | 8  | A1 |
| 28.0 | PE-V0-417-155-A030   | CIVIL ASSIGNMENT DRAWING OF CONDENSATE POLISHING UNIT (REGENERATION AREA)                    | 8  | A1 |
| 29.0 | PE-V0-417-155-A031 * | P&I DIAGRAM FOR CONDENSATE POLISHING UNIT                                                    | 4  | A1 |
| 30.0 | PE-V0-417-155-A032 * | EQUIPMENT LAYOUT OF CONDENSATE POLISHING UNIT (SERVICE VESSEL AREA )                         | 4  | A1 |
| 31.0 | PE-V0-417-155-A033 * | EQUIPMENT LAYOUT OF CONDENSATE POLISHING UNIT (REGENERATION AREA)                            | 4  | A1 |
| 32.0 | PE-V0-417-155-A034   | PIPING LAYOUT (REGENERATION AREA ) FOR CONDENSATE POLISHING UNIT                             | 10 | A1 |
| 33.0 | PE-V0-417-155-A035   | YARD PIPING LAYOUT FOR CONDENSATE POLISHING UNIT                                             | 16 | A1 |
| 36.0 | PE-V0-417-155-A036   | PG test procedure for condensate polishing unit                                              | 20 | A4 |
| 37.0 | PE-V0-417-155-A037   | PIPING LAYOUT (SERVICE VESSEL AREA) FOR CONDENSATE POLISHING UNIT                            | 10 | A1 |
| 38.0 | PE-V0-417-155-A038   | VALVE SCHEDULE FOR CONDENSATE POLISHING UNIT                                                 | 12 | A3 |
| 39.0 | PE-V0-417-155-A039   | INSTRUMENT SCHEDULE FOR CONDENSATE POLISHING UNIT                                            | 12 | A3 |
| 40.0 | PE-V0-417-155-A040   | VALVE SEQUENCE CHART FOR CONDENSATE POLISHING UNIT                                           | 10 | A3 |
| 41.0 | PE-V0-417-155-A041 * | SUB-VENDOR LIST AND INSPECTION CRITERIA                                                      | 4  | A4 |
| 42.0 | PE-V0-417-155-A042   | I/O LIST FOR CONDENSATE POLISHING UNIT                                                       | 10 | A4 |
| 43.0 | PE-V0-417-155-A043   | DRIVE LIST FOR CONDENSATE POLISHING UNIT                                                     | 12 | A4 |
| 44.0 | PE-V0-417-155-A044   | CABLE TRAY/TRENCH & CONDUIT ROUTING AND EARTHING LAYOUT DIAGRAM FOR CPU(REGENERATION AREA)   | 12 | A1 |
| 45.0 | PE-V0-417-155-A045   | CABLE TRAY/TRENCH & CONDUIT ROUTING AND EARTHING LAYOUT DIAGRAM FOR CPU(SERVICE VESSEL AREA) | 12 | A1 |
| 46.0 | PE-V0-417-155-A046   | CABLE SCHEDULE FOR CONDENSATE POLISHING UNIT                                                 | 16 | A3 |
| 47.0 | PE-V0-417-155-A047   | O&M MANUAL FOR CONDENSATE POLISHING UNIT                                                     | 24 | A4 |

**Note-** The drawing/document marked as (\*) shall be considered as basic drawings/documents. In addition to above bidder to refer Sub Section-, IA, IB, IC, IIB & IIC for documents related to Electrical & Control & instrumentation respectively.

Bidder to note that the successful bidder, during detail engineering, will submit the drg/doc through web based Document Management System in addition to hard copies to be submitted as per the Sub-



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Section IA Annexure VII of this specification. Bidder would be provided access to the DMS for drg/doc 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)
- 1. 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>

## **18.0 SPARES**

The Bidder shall include in his scope of supply all the necessary Mandatory spares, start up and commissioning spares as indicated in the relevant sections of specifications. The general requirements pertaining to the supply of these spares is given below: -

### **16.1 RECOMMENDED SPARES:**

The bidder shall also furnish list of recommended spares parts for three (3) years normal operation with unit prices. These recommended spares shall be those considered necessary by the bidder on a stand-alone basis. The BHEL reserves the right to buy any of the recommended spare parts as considered necessary by him.

The recommended spares shall be delivered at project site at least two months before the scheduled date of initial operation of first unit. However, the spares shall not be dispatched before the dispatch of the main equipment. The price of these spars will remain valid upto 6 months after placement of Notification of Award for the main equipment. However, the Bidder shall be liable to provide necessary justification for the quoted prices for these spares as desired by the BHEL/Customer.

### **16.2 MANDATORY SPARES:**

All Mandatory spares listed in Sub-Section IA Annexure VI of this specification are in bidder's scope of supply.

All the Mandatory spares for the equipment under the contract provided by the vendor will strictly conform to the specifications and documents and will be identical to the corresponding main Equipment/components supplied under the contract.

Whenever the quantity is mentioned in "sets" the bidder has to give the item details and prices of each item.

All mandatory spares shall be delivered at site at least two months before scheduled date of initial Operation of the first unit. However, spares shall not be dispatched before dispatch of corresponding main equipments.

Wherever quantity is specified both as a percentage and a value, the Bidder has to supply the higher quantity until and unless specified otherwise.





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Inspection of mandatory spares shall be in line with the approved quality plans for the respective items/equipments. The inspection categorisation of mandatory spares shall also be in line with the approved categorisation plan for the respective items/equipment.

### **16.3 START-UP & COMMISSIONING SPARES**

Start-up and commissioning spares are those spares which are required during the start-up and commissioning of the equipment/system. All spares used till the plant is handed over to the BHEL/Customer shall come under this category. The Bidder shall provide for an adequate stock of such start up and commissioning spares to be brought by him to the site for the plant erection and commissioning. They must be available at site before the equipments are energized. The unused spares, if any, should be removed from there only after the issue of Taking Over certificate. All start up spares which remain unused at the time shall remain the property of the Bidder.

Notes:

- 1) The Bidder shall indicate the service expectancy period for the spares parts (mandatory) under normal operating conditions before replacement is necessary.
- 2) That all spares supplied will be new and in accordance with the contract document and will be free from defects in design, material and workmanship and shall further guarantee as under.
- 3) In case of any failure in the original component/equipment's due to faulty designs, materials and workmanship, the corresponding spare parts if any, supplied will be replaced without any extra cost to the BHEL and customer unless a joint examination and analysis by BHEL and/or customer of such spare parts prove that the defect found in the original part that failed can safely be assured not to be present in spare parts.
- 4) All spares supplied under this contract shall be strictly interchangeable with the parts for which they are intended for replacements. 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 with desecrator packs as necessary.
- 5) All the spares (mandatory) shall be manufactured along with the main equipment components as a continuous operation as per same specification and quality plan.
- 6) Each spares part shall be clearly marked or labelled on the outside of the packing with its description. When more than one spares part is packed in a single case, a general description of the content shall be shown on the outside of such case and a detailed list enclosed. All cases, containers and other packages must be suitably marked and numbered for the purposes of identification.
- 7) All cases, containers or other packages are to be opened for such examination as may be considered necessary by BHEL / Customer.
- 8) The Bidder will provide the BHEL/Customer with all the addresses and particulars of his sub suppliers while placing the order on vendors for items/components/equipments covered under the contract and will further ensure with his vendors that the BHEL/Customer, if so desires, will have the right to place order for spares directly on them on mutually agreed terms based on offers of such vendors.
- 9) The Bidder shall warrant that all spares supplied will be new and in accordance with the contract Documents and will be free from defects in design, material and workmanship.
- 10) The bidder to provide datasheets/assembly drawings of the manufacturer/ any other relevant document showing Bill of Material(s), Make, Model Number, Part Number etc. through which the mandatory spares to be supplied can be uniquely identified.



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11) The bidder shall guarantee the long term availability of spares to the BHEL/Customer for the full life of the equipment covered under the contract. The Bidder shall guarantee that before going out of production of spares parts of the equipment covered under the Contract, He shall give the BHEL/Customer at least 2 years advance notice so that the latter may order his bulk requirement of spares, if he so desires. The same provision will also be applicable to sub-vendors. Further, in case of discontinuance of manufacture of any spares by the Bidder and/or his sub-vendors, bidder will provide the BHEL/Customer, two years in advance, with full manufacturing drawings, material specifications and technical information including information on alternative equivalent makes required by BHEL /Customer for the purpose of procurement of such items.

12) Further in case of discontinuance of supply of spares by the vendors or his sub-vendors, the vendor will provide the BHEL and the customer with full information for replacement of such spares with other equivalent makes, if so required by the BHEL and the customer.

13) Notwithstanding the above, the vendor shall be responsible for supply of spares for the lifetime of the package at reasonable prices. The prices of all future requirements of spares shall be derived from the corresponding ex-works price at which the orders for such spares have been placed by the BHEL and the customer as a part of the mandatory or long term or any other kind of spares. The base indices for calculating ex-works price shall be commissioning of last equipment under main contract

14) Wherever quantity has been specified as percentage (%), it shall mean percentage (%) of the total population of the item as defined elsewhere in this specification, unless specified otherwise and the fraction will be rounded off to the next higher whole number.

15) Wherever the quantities have been indicated for each type, size, thickness, material, radius, range etc. these shall cover all the items supplied and installed and the break up for these shall be furnished.

16) In case spares indicated in the list are not applicable to the particular design offered by the bidder, the bidder should offer spares applicable to offered design with quantities.

17) The Bidder will indicate the delivery period of the spares, which the BHEL and the customer may procure in accordance with this clause.

18) In case of emergency requirements of spares, the vendor would make every effort to expedite the manufacture and delivery of such spares on the basis of mutually agreed time schedule.

19) In case the vendor fails to supply the mandatory or long term or any other kind of spares on the terms stipulated above, the BHEL and the customer shall be entitled to purchase the same from the alternate sources at the risk and the cost of the vendor and recover from the vendor, the excess amount paid by the BHEL and the customer over the rates as per the contract. In the event of such risk purchase by the BHEL or the customer, the purchases will be as per the works and procurement policy of the BHEL and the customer prevalent at the time of such purchases and BHEL & the customer at his option may include a representative from the vendor in finalizing the purchases.

20) It is expressly understood that the final settlement between the parties in terms of relevant clauses of the tender document shall not relieve the vendor of any of his obligations under the provision of long term availability of spares and such provisions shall continue to be enforced till the expiry of 30 (thirty) years period reckoned from the scheduled date of completion of trial operation of the last equipment unless otherwise discharged expressly in writing by the BHEL or the customer.

## **19.0 MISCELLANEOUS REQUIREMENT**

- I. Bidders is advised to visit the site in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details wrt existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the



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successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.

- II. The complete system shall be proven and necessary design documentation in support of proveness shall be submitted by the successful bidder in support of the systems, if asked by the customer without any price and delivery implication to BHEL and customer.
- III. System to be designed to meet all the statutory requirements. Preparation of all necessary drawings/data/ documents for obtaining necessary Approval of statutory authorities like CCOE, IBR, Weight & Measures Department and any other agency/ competent authority, on behalf of the customer, related to installation of CPU plant (if required) is included in bidder's scope. All expenses required to obtain the approval shall also be borne by the successful bidder. Successful bidder shall inform customer well in advance requirement of authority letter along with format for the same. After issuance of authority letter by customer, it will be vendor's responsibility to regularly follow up with the concerned authorities to obtain timely approval from these authorities. Any delay on account of the same, unless any specific information related to above approval to be furnished by customer is delayed by customer, shall be to vendor's account and shall not be used as a reason for extension in contract completion.
- IV. Vendor to attend regular engineering meeting with BHEL and customer fortnightly in BHEL or customer office as decided during detail engineering. Vendor will depute all his concerned engineering representative along with the project manager for discussion and approval. Meeting can be held at site also.
- V. The requirements mentioned in section –I shall prevail and govern in case of conflict between requirements mentioned in section I & section –II for any item or equipment or system.
- VI. In case of any conflict and repetition of clauses in the specification, the more stringent requirements among them are to be complied with.
- VII. Latest version of all codes and standards to be followed.
- VIII. CPU regeneration facilities (except bulk acid & alkali storage and Neutralisation pit which area kept in open) shall be housed in RCC Building. Control room, battery room & MCC room for CPU plant shall be housed shall be located in RCC building. RCC building shall have toilet blocks for ladies and gents.
- IX. Any statutory requirement / clearance required for the package from government / local body shall be in bidder's scope.
- X. All interconnecting piping, valves, fittings including dosing piping, drain piping from tanks to nearby drain, flushing lines from nearest available water source, valves, fittings and accessories is also in bidder's scope.
- XI. All the vertical pumps shall be self-lubricating type.
- XII. 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 shall be taken from BHEL. 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.



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- XIII. KKS numbering if required, as per BHEL/Customer requirement shall be provided by the Bidder during detailed engineering stage without any commercial/delivery implication to BHEL.
- XIV. Any item/work either supply of equipment or erection material which have not been specifically mentioned but are necessary to complete the works for trouble free and efficient operation of the plant shall be deemed to be included within the scope of this specification. The bidder without any extra charge shall provide the same.
- XV. Buried piping shall be protected as under (as per IS-10221).  
Surface cleaning by wire brush, power tool cleaning etc.  
Apply one coat of coaltar/primer/enamel.  
Apply one layer of tape comprising of coaltar. Application of tape shall conform to AWWA C- 203/IS 10221 (Appendix-B) with Minimum thickness of tape as 4MM +10%
- XVI. All drawings/documents shall be approved by BHEL/Customer during detailed engineering stage. Successful Bidder shall comply with the comment of the customer/BHEL without price & delivery implication.
- XVII. Successful bidder shall furnish detailed erection manual for each of the equipment as well as complete system 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.
- XVIII. Final Electrical Load list will be submitted by the successful bidder as per agreed drawing/ doc submission schedule. Thereafter any change in the electrical load list shall be entertained only subject to its feasibility, and BHEL reserves the right to debit the vendor cost of any changes necessitated in the switch gear /MCC on account of changed loads.
- XIX. Wherever CIVIL works is excluded from the bidder's scope, successful bidder shall furnish civil assignment / scope drawings. The corresponding CIVIL drawing prepared by BHEL / CIVIL agency, based on civil assignment drawing of bidder will be furnished to the successful bidder for concurrence. In case any modification is required in the civil work already carried out based on final civil inputs given by bidder, BHEL reserves the right to debit cost of such rework to bidder.
- XX. 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.
- XXI. Bidders shall make Site visit in order to familiarize themselves with existing condition of site before submitting the bid in order to make their offer complete. During detail engineering also, the successful bidder shall be responsible for the correctness of details w.r.t. existing facility at site. Customer approval on any drawing having details of existing facility shall not be cited by the successful bidder a valid reason for any shortcoming in the work by them. BHEL shall also not entertain any cost implication for any lack of input data with regard to site during detail engineering.
- XXII. While all efforts have been made to make the specification requirement complete & unambiguous, it shall be bidders' responsibility to ask for missing information, ensure completeness of specification, to bring out any contradictory / conflicting requirement in different sections & sub - sections of the specification and within a section itself to the notice of BHEL and to seek any clarification on specification requirement in the format enclosed under SECTION -III of the specification. In absence of any such clarifications, in case of any contradictory requirement, the more stringent requirement as per interpretation of Purchaser / Customer shall prevail and shall be complied by the bidder without any commercial implication on account of the same. Further in case of any missing information in the specification not brought out by the prospective bidders as part of pre-bid clarification, the same shall be furnished by Purchaser/ Customer as and when brought to



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their notice either by the bidder or by purchaser/ customer themselves. However, such requirements shall be binding on the successful bidder without any commercial & delivery implication to BHEL / Customer.

- XXIII. The bidder shall be responsible for providing all material, equipment & services, which are required to fulfil the intent of ensuring operability, maintainability, reliability and complete safety of the complete work covered under this specification, irrespective of whether it has been specifically listed herein or not. Items though not specifically mentioned but needed to make the system complete as stipulated under these specifications are also to be furnished unless otherwise specifically excluded. Omission of specific reference to any component / accessory necessary for proper performance of the equipment shall not relieve the vendor from the responsibility of providing such facilities to complete the supply and erection & commissioning of condensate polishing unit.
- XXIV. It is not the intent to specify herein all the details of design and manufacture. However, the equipment shall conform in all respects to high standards of design, engineering and workmanship and shall be capable of performing the required duties in a manner acceptable to purchaser who will interpret the meaning of drawings and specifications and shall be entitled to reject any work or material which in his judgment is not in full accordance herewith.
- XXV. The extent of supply under the contract includes all items shown in the drawings, notwithstanding the fact that such items may have been omitted from the specification or schedules. Similarly, the extent of supply also includes all items mentioned in the specification and /or schedules, notwithstanding the fact that such items may have been omitted in the drawing.
- XXVI. The general term and conditions, instructions to tenderer and other attachment referred to elsewhere are made part of the tender specification. The equipment materials and works covered by this specification are subject to compliance to all attachments referred in the specification. The bidder shall be responsible for and governed by all requirements stipulated herein.
- XXVII. Deviations along with cost of withdrawal (positive or negative), if any, should be very clearly brought out clause by clause in the enclosed schedule; otherwise, it will be presumed that the vendor's offer is strictly in line with tender specification & there is no deviation. (Price to be given in sealed envelope only.)
- XXVIII. In case all above requirements are not complied with, the offer may be considered as incomplete and would become liable for rejection.
- XXIX. Unless specified otherwise, all through the specification, the word contractor shall have same meaning as successful bidder / vendor and Customer / Purchaser / Employer will mean BHEL and /or TELANGANA STATE POWER GENERATION CORPORATION LIMITED (TSGENCO), HYDERABAD and /or TCE (customer's assigned consultant).
- XXX. The equipment covered under this specification shall not dispatch unless the same have been finally inspected, accepted and shipping release issue by BHEL/Customer.
- XXXI. BHEL's/Customer's representative shall be given full access to the shop in which the equipments are being manufactured or tested and all test records shall be made available to him.

**20.0 BIDDER TO FURNISH 4 SETS OF TECHNO-COMMERCIAL BID INCLUDING FOLLOWING DOCUMENTS/INFORMATION (FOR ELECTRICAL AND C&I PLEASE REFER THE RESPECTIVE SECTION OF THE SPECIFICATION).**

- Deviation if any in the enclosed Schedule of deviation with cost of withdrawal only with mention of specification clause for which deviation is being asked. (Stamped & Signed)
- Compliance certificate. (Stamped & Signed)