



TITLE:

**TECHNICAL SPECIFICATION  
SELF CLEANING STRAINER**

**STANDARD TECHNICAL REQUIREMENTS**

SPEC. NO.: **PE-TS-421-165-N004**

SECTION: **II**

SUB-SECTION: **IIB**

REV. NO. **0** DATE **20.12.2017**

SHEET **1** OF **1**

## **SUB-SECTION - IIB**

### **STANDARD TECHNICAL SPECIFICATION (ELECTRICAL)**

|            |                     |                                                                                       |        |
|------------|---------------------|---------------------------------------------------------------------------------------|--------|
| CLAUSE NO. | Bidder's Name ..... |                                                                                       |        |
|            | DE-                 | LT MOTORS                                                                             |        |
|            | A.                  | GENERAL                                                                               |        |
|            | 1.                  | Manufacturer & Country of origin. (Shall be as per approved QA make)                  |        |
|            | 2.                  | Equipment driven by motor                                                             |        |
|            | 3.                  | Motor type                                                                            |        |
|            | 4.                  | Quantity                                                                              |        |
|            | B.                  | DESIGN AND PERFORMANCE DATA                                                           |        |
|            | 1.                  | Frame size                                                                            |        |
|            | 2.                  | Type of duty                                                                          |        |
|            | 3.                  | Type of enclosure /Method of cooling/ Degree of                                       |        |
|            | 4.                  | Applicable standard to which motor generally                                          |        |
|            | 5.                  | Efficiency class as per IS                                                            |        |
|            | 6.                  | (a)Whether motor is flame proof                                                       | Yes/No |
|            |                     | (b)If yes, the gas group to which it conforms as per                                  |        |
|            | 7.                  | Type of mounting                                                                      |        |
|            | 8.                  | Direction of rotation as viewed from DE END                                           |        |
|            | 9.                  | Standard continuous rating at 40 deg.C. ambient temp. as per Indian Standard (KW)     |        |
|            | 10.                 | Derated rating for specified normal condition i.e. 50 deg. C ambient temperature (KW) |        |
|            | 11.                 | Maximum continuous load demand of driven                                              |        |
|            | 12.                 | Rated Voltage (volts)                                                                 |        |
|            | 13.                 | Permissible variation of :                                                            |        |
|            |                     | a. Voltage (Volts)                                                                    |        |
|            |                     | b. Frequency (Hz)                                                                     |        |
|            |                     | c. Combined voltage and frequency                                                     |        |
|            | 14.                 | Rated speed at rated voltage and                                                      |        |
|            | 15.                 | At rated Voltage and frequency:                                                       |        |
|            |                     | a. Full load current                                                                  |        |

|            |                                                 |                                                    |
|------------|-------------------------------------------------|----------------------------------------------------|
| CLAUSE NO. | Bidder's Name .....                             |                                                    |
|            |                                                 | b. No load current                                 |
|            | 16.                                             | Power Factor at                                    |
|            |                                                 | a. 100% load                                       |
|            |                                                 | b. NO load                                         |
|            |                                                 | c. Starting.                                       |
|            | 17.                                             | Efficiency at rated voltage and frequency,         |
|            |                                                 | a.100% load                                        |
|            |                                                 | b. 75% load                                        |
|            |                                                 | c. 50% load                                        |
|            | 18.                                             | Starting current (amps) at                         |
|            |                                                 | a. 100 % voltage                                   |
|            |                                                 | b. 85% voltage                                     |
|            |                                                 | c. 80% voltage                                     |
|            | 19.                                             | Minimum permissible starting Voltage (Volts)       |
|            | 20.                                             | Starting time with minimum permissible voltage     |
|            |                                                 | a. Without driven equipment coupled                |
|            |                                                 | b. With driven equipment coupled                   |
|            | 21.                                             | Safe stall time with 100% and 110% of rated        |
|            |                                                 | a. From hot condition                              |
|            |                                                 | b. From cold condition                             |
|            | 22.                                             | Torques :                                          |
|            |                                                 | a. Starting torque at min. permissible voltage(kg- |
|            |                                                 | b. Pull up torque at rated voltage.                |
|            |                                                 | c. Pull out torque                                 |
|            | d. Min accelerating torque (kg.m) available     |                                                    |
|            | e.Rated torque (kg.m)                           |                                                    |
| 23.        | Stator winding resistance per phase (ohms at 20 |                                                    |
| 24.        | GD2 value of motors                             |                                                    |

| CLAUSE NO. | Bidder's Name ..... |                                                                             |  |
|------------|---------------------|-----------------------------------------------------------------------------|--|
|            | 25.                 | No of permissible successive starts when motor is in hot condition          |  |
|            | 26.                 | Locked Rotor KVA Input                                                      |  |
|            | 27.                 | Locked Rotor KVA/KW                                                         |  |
|            | 28.                 | Vibration limit :Velocity (mm/s)                                            |  |
|            | 29.                 | Noise level limit (dBA)                                                     |  |
|            | <b>C.</b>           | <b>CONSTRUCTIONAL FEATURES</b>                                              |  |
|            | 1.                  | Stator winding insulation                                                   |  |
|            |                     | a. Class & Type                                                             |  |
|            |                     | b. Winding Insulation Process                                               |  |
|            |                     | c. Tropicalised (Yes/No)                                                    |  |
|            |                     | d. Temperature rise over specified maximum ambient temperature of 50 deg C  |  |
|            |                     | e. Method of temperature measurement                                        |  |
|            |                     | f. Stator winding connection                                                |  |
|            | 2.                  | Main Terminal Box                                                           |  |
|            |                     | a. Type                                                                     |  |
|            |                     | b. Location(viewed from NDE side)                                           |  |
|            |                     | c. Entry of cables(bottom/side)                                             |  |
|            |                     | d. Recommended cable size(To be matched with cable size envisaged by owner) |  |
|            |                     | e. Fault level (MVA),Fault level duration(sec)                              |  |
|            |                     | f. Cable glands & lugs details (shall be suitable for                       |  |
|            | 3.                  | Type of DE/NDE Bearing                                                      |  |
|            | 4.                  | Motor Paint shade                                                           |  |
|            | 5.                  | Weight of                                                                   |  |
|            |                     | a. Motor stator (KG)                                                        |  |
|            |                     | b. Motor Rotor (KG)                                                         |  |
|            |                     | c. Total weight (KG)                                                        |  |

|            |                     |                                                                                         |
|------------|---------------------|-----------------------------------------------------------------------------------------|
| CLAUSE NO. | Bidder's Name ..... |                                                                                         |
|            | <b>D.</b>           | <b>List of accessories.</b>                                                             |
|            | 1.                  | Space Heaters (Applicable for 30 KW & above motor) (Nos./Power in watts/supply voltage) |
|            | 2.                  | Terminal Box for Space Heater (Yes/No)                                                  |
|            | 3.                  | Speed switch (Yes/No)                                                                   |
|            | 4.                  | Insulation of bearing (Yes/No)                                                          |
|            | 5.                  | Noise reducer(Yes/No)                                                                   |
|            | 6.                  | Grounding pads                                                                          |
|            |                     | i) No and size on motor body                                                            |
|            |                     | ii) Nos on terminal Box                                                                 |
|            | 7.                  | Vibration pads                                                                          |
|            |                     | i) Nos and size                                                                         |
|            |                     | ii) Location                                                                            |
|            | 8.                  | Any other fitments                                                                      |
|            | <b>E.</b>           | <b>List of curves.</b>                                                                  |
|            | 1.                  | Torque speed characteristic of the motor                                                |
|            | 2.                  | Thermal withstand characteristic                                                        |
|            | 3.                  | Starting. current Vs. Time                                                              |
|            | 4.                  | Starting. current Vs speed                                                              |
|            | 5.                  | P.F. and Effi. Vs Load                                                                  |
|            | <b>F.</b>           | <b>Additional Data to be filled for each rating of DC Motor</b>                         |
|            | 1.                  | Rated armature voltage (Volt)                                                           |
|            | 2.                  | Rated field excitation (Amp)                                                            |
|            | 3.                  | Permissible % variation in voltage                                                      |
|            | 4.                  | Minimum Permissible Starting voltage (volt)                                             |
|            | 5.                  | At rated voltage                                                                        |
|            |                     | i)Full load Armature current.(Amp)                                                      |

|            |                     |                                                                                                             |
|------------|---------------------|-------------------------------------------------------------------------------------------------------------|
| CLAUSE NO. | Bidder's Name ..... |                                                                                                             |
|            |                     | ii)Full load Field current (Amp)                                                                            |
|            |                     | iii)No load Armature current (Amp)                                                                          |
|            | 6.                  | Full load Field current (Amp)                                                                               |
|            | 7.                  | No load Aramature current (Amp)                                                                             |
|            | 8.                  | Minimum permissible field current(Amp) to avoid                                                             |
|            |                     | i) Maximum permissible voltage                                                                              |
|            |                     | ii) Rated voltage                                                                                           |
|            |                     | iii) Minimum Permissible Voltage                                                                            |
|            | 9.                  | Resistance (indicative Values) in ohm                                                                       |
|            |                     | i)Armature winding(Arm + IP + Series) at 25                                                                 |
|            |                     | ii) Field Winding at 25 deg. C                                                                              |
|            | 10..                | Inductance (indicative values)                                                                              |
|            |                     | i) Armature winding                                                                                         |
|            |                     | ii) Field winding                                                                                           |
|            | 11                  | Value of trimmer resistance (ohm) to be connected in series with the shunt field to                         |
|            |                     | i) 220 V DC                                                                                                 |
|            |                     | ii) 250 V DC                                                                                                |
|            |                     | iii) 187 V DC                                                                                               |
|            | 12                  | Value of the external resistance (ohm)required to be connected in series with armature during starting only |
|            | 13                  | Technical data sheet for external resistance box                                                            |
|            | 14                  | GA drawing of motor                                                                                         |
|            | 15                  | Starting time calculation                                                                                   |
|            | 16                  | Starter resistance design calculation                                                                       |
|            | 17                  | Electrical connection diagram of motor                                                                      |
|            |                     |                                                                                                             |

|         |                     | QUALITY PLAN                                                             | CUSTOMER :          |                            |                 | PROJECT TITLE                                       |                                                |                  | SPECIFICATION :<br>NUMBER : |         |   |            |                        |
|---------|---------------------|--------------------------------------------------------------------------|---------------------|----------------------------|-----------------|-----------------------------------------------------|------------------------------------------------|------------------|-----------------------------|---------|---|------------|------------------------|
|         |                     |                                                                          | BIDDER/ :<br>VENDOR |                            |                 | QUALITY PLAN<br>NUMBER PED-506-00-Q-006, REV-01     |                                                |                  | SPECIFICATION<br>TITLE      |         |   |            |                        |
|         |                     | SHEET 1 OF 2                                                             |                     | SYSTEM                     |                 |                                                     | ITEM AC ELECT. MOTORS BELOW 55KW (LV)          |                  |                             | SECTION |   | VOLUME III |                        |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTICS CHECK                                                    | CAT.                | TYPE/METHOD OF CHECK       | EXTENT OF CHECK | REFERENCE DOCUMENT                                  | ACCEPTANCE NORM                                | FORMAT OF RECORD | AGENCY                      |         |   | REMARKS    |                        |
| 1       | 2                   | 3                                                                        | 4                   | 5                          | 6               | 7                                                   | 8                                              | 9                | 10                          | P       | W | V          | 11                     |
| 1.0     | ASSEMBLY            | 1.WORKMANSHIP                                                            | MA                  | VISUAL                     | 100%            | MANUF'S SPEC                                        | MANUF'S SPEC                                   | -DO-             | 2                           | -       | - |            |                        |
|         |                     | 2.DIMENSIONS                                                             | MA                  | -DO-                       | -DO-            | MFG. DRG./<br>MFG. SPEC.                            | MFG. DRG./<br>MFG. SPEC.                       | -DO-             | 2                           | -       | - |            |                        |
|         |                     | 3.CORRECTNESS<br>COMPLETENESS<br>TERMINATIONS/<br>MARKING/COLOUR<br>CODE | MA                  | VISUAL                     | 100%            | MFG.SPEC./<br>RELEVANT IS                           | MFG.SPEC.<br>RELEVANT IS                       | -DO-             | 2                           | -       | - |            |                        |
| 2.0     | PAINTING            | 1.SHADE                                                                  | MA                  | VISUAL                     | SAMPLE          | MANUFR'S<br>SPEC/BHEL<br>SPEC./RELEVANT<br>STANDARD | BHEL SPEC.<br>SAME AS<br>COL.7                 | LOG BOOK         | 2                           | -       | - |            |                        |
| 3.0     | TESTS               | 1.ROUTINE<br>TEST INCLUDING<br>SPECIAL TEST<br>AS PER BHEL<br>SPEC.      | MA                  | -DO-                       | 100%            | IS-325/<br>BHEL SPEC./<br>DATA SHEET                | SAME AS<br>COL.7                               | TEST<br>REPORT   | 2                           | 1       |   |            | NOTE -1<br>&<br>NOTE-3 |
|         |                     | 2.OVERALL<br>DIMENSIONS &<br>ORIENTATION                                 | MA                  | MEASUREMENT<br>&<br>VISUAL | 100%            | APPROVED<br>DRG/DATA<br>SHEET                       | APPROVED<br>DRG/DATA<br>SHEET<br>& RELEVANT IS | INSPN.<br>REPORT | 2                           | 1       | - |            | NOTE -1<br>&<br>NOTE-3 |
| BHEL    |                     |                                                                          | PARTICULARS         |                            |                 | BIDDER/VENDOR                                       |                                                |                  |                             |         |   |            |                        |
|         |                     |                                                                          | NAME                |                            |                 |                                                     |                                                |                  |                             |         |   |            |                        |
|         |                     |                                                                          | SIGNATURE           |                            |                 |                                                     |                                                |                  |                             |         |   |            |                        |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                     | <b>QUALITY PLAN</b>   |             | CUSTOMER :           |                 | PROJECT<br>TITLE                                |                     |                  | SPECIFICATION :<br>NUMBER :   |   |            |         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------|-------------|----------------------|-----------------|-------------------------------------------------|---------------------|------------------|-------------------------------|---|------------|---------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                       |             | BIDDER/ :<br>VENDOR  |                 | QUALITY PLAN<br>NUMBER PED-506-00-Q-006, REV-01 |                     |                  | SPECIFICATION :<br>TITLE :    |   |            |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     | SHEET 2 OF 2          |             | SYSTEM               |                 | ITEM AC ELECT. MOTORS BELOW 55KW (LV)           |                     |                  | SECTION                       |   | VOLUME III |         |
| SL. NO.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | COMPONENT/OPERATION | CHARACTERISTICS CHECK | CAT.        | TYPE/METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT                              | ACCEPTANCE NORM     | FORMAT OF RECORD | AGENCY                        |   |            | REMARKS |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2                   | 3                     | 4           | 5                    | 6               | 7                                               | 8                   | 9                | P                             | W | V          | 11      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     | 3.NAMEPLATE DETAILS   | MA          | VISUAL               | 100%            | IS-325 & DATA SHEET                             | IS-325 & DATA SHEET | INSPN. REPORT    | 2                             | 1 | -          |         |
| <p>NOTES:</p> <p>1 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON</p> <p>2 WHERE EVER CUSTOMER IS INVOLVED IN INSPECTION, (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</p> <p>3 FOR EXHAUST/VENTILATION FAN MOTORS OF RATING UPTO 1.5KW , ONLY ROUTINE TEST CERTIFICATES SHALL BE FURNISHED FOR SCRUTINY.</p> <p><u>Legends for Inspection agency</u></p> <p>1. BHEL/CUSTOMER<br/>2. VENDOR (MOTOR MANUFACTURER)<br/>3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)</p> <p>P. PERFORM<br/>W. WITNESS<br/>V. VERIFY</p> |                     |                       |             |                      |                 |                                                 |                     |                  |                               |   |            |         |
| BHEL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                     |                       | PARTICULARS |                      | BIDDER/VENDOR   |                                                 |                     |                  | BIDDER'S/VENDORS COMPANY SEAL |   |            |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                       | NAME        |                      |                 |                                                 |                     |                  |                               |   |            |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                       | SIGNATURE   |                      |                 |                                                 |                     |                  |                               |   |            |         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     |                       | DATE        |                      |                 |                                                 |                     |                  |                               |   |            |         |

|  |                                        | <b>QUALITY PLAN</b><br>SHEET 1 OF 9 |             | CUSTOMER :           |                 |                        | PROJECT TITLE                                   |                    |                               | SPECIFICATION :<br>NUMBER : |   |                                                       |
|-----------------------------------------------------------------------------------|----------------------------------------|-------------------------------------|-------------|----------------------|-----------------|------------------------|-------------------------------------------------|--------------------|-------------------------------|-----------------------------|---|-------------------------------------------------------|
|                                                                                   |                                        |                                     |             | BIDDER/ :<br>VENDOR  |                 |                        | QUALITY PLAN<br>NUMBER PED-506-00-Q-007, REV-03 |                    |                               | SPECIFICATION :<br>TITLE    |   |                                                       |
|                                                                                   |                                        |                                     |             | SYSTEM               |                 |                        | ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)  |                    |                               | SECTION VOLUME III          |   |                                                       |
| SL. NO.                                                                           | COMPONENT/OPERATION                    | CHARACTERISTIC CHECK                | CAT.        | TYPE/METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT     | ACCEPTANCE NORM                                 | FORMAT OF RECORD   | AGENCY                        |                             |   | REMARKS                                               |
| 1                                                                                 | 2                                      | 3                                   | 4           | 5                    | 6               | 7                      | 8                                               | 9                  | P                             | W                           | V | 11                                                    |
| 1.0                                                                               | RAW MATERIAL & BOUGHT OUT CONTROL      |                                     |             |                      |                 |                        |                                                 |                    |                               |                             |   |                                                       |
| 1.1                                                                               | SHEET STEEL, PLATES, SECTION, EYEBOLTS | 1.SURFACE CONDITION                 | MA          | VISUAL               | 100%            | -                      | FREE FROM BLINKS, CRACKS, WAVINESS ETC          | LOG BOOK           | 3                             | -                           | - |                                                       |
|                                                                                   |                                        | 2.DIMENSIONS                        | MA          | MEASUREMENT          | SAMPLE          | MANFR'S DRG./SPEC      | MANFR'S DRG./SPEC                               | -DO-               | 3                             | -                           | - |                                                       |
|                                                                                   |                                        | 3.PROOF LOAD TEST (EYE BOLT)        | MA          | MECH. TEST           | -DO-            | -DO-                   | -DO-                                            | INSPEC. REPORT     | 3                             | -                           | 2 |                                                       |
| 1.2                                                                               | HARDWARES                              | 1.SURFACE CONDITION                 | MA          | VISUAL               | 100%            |                        | FREE FROM CRACKS, UN-EVENNESS ETC.              | -DO-               | 3                             | -                           | - |                                                       |
|                                                                                   |                                        | 2.PROPERTY CLASS                    | MA          | VISUAL               | SAMPLES         | MANFR'S DRG./SPEC BOOK | RELEVANT IS/SPEC.                               | SUPPLIERS TC & LOG | 3                             | -                           | 2 | PROPERTY CLASS MARKING SHALL BE CHECKED BY THE VENDOR |
| 1.3                                                                               | CASTING                                | 1.SURFACE CONDITION                 | MA          | VISUAL               | 100%            |                        | FREE FROM CRACKS, BLOW HOLES ETC.               | LOG BOOK           | 3                             | -                           | 2 |                                                       |
|                                                                                   |                                        | 2.CHEM. & PHY. PROP.                | MA          | CHEM & MECH TEST     | 1/HEAT NO.      | MANFR'S DRG./SPEC      | RELEVANT IS/                                    | SUPPLIER'S TC      | 3                             | -                           | 2 | HEAT NO. SHALL BE VERIFIED                            |
|                                                                                   |                                        | 3.DIMENSIONS                        | MA          | MEASUREMENT          | 100%            | MANUFR'S DRG.          | MANUFR'S DRG.                                   | LOG BOOK           | 3                             | -                           | 2 |                                                       |
| 1.4                                                                               | PAINT & VARNISH                        | 1.MAKE, SHADE, SHELF LIFE & TYPE    | MA          | VISUAL               | 100% CONTINUOUS | MANFR'S DRG./SPEC      | MANFR'S DRG./SPEC                               | LOG BOOK           | 3                             | -                           | 2 |                                                       |
| BHEL                                                                              |                                        |                                     | PARTICULARS |                      |                 | BIDDER/VENDOR          |                                                 |                    |                               |                             |   |                                                       |
|                                                                                   |                                        |                                     | NAME        |                      |                 |                        |                                                 |                    |                               |                             |   |                                                       |
|                                                                                   |                                        |                                     | SIGNATURE   |                      |                 |                        |                                                 |                    |                               |                             |   |                                                       |
|                                                                                   |                                        |                                     | DATE        |                      |                 |                        |                                                 |                    | BIDDER'S/VENDORS COMPANY SEAL |                             |   |                                                       |

|  |                                                                                                          | <b>QUALITY PLAN</b><br>SHEET 2 OF 9 |             | CUSTOMER :               |                                       |                      | PROJECT TITLE                                   |                  |                               | SPECIFICATION :<br>NUMBER : |    |                                                      |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------|-------------------------------------|-------------|--------------------------|---------------------------------------|----------------------|-------------------------------------------------|------------------|-------------------------------|-----------------------------|----|------------------------------------------------------|
|                                                                                   |                                                                                                          |                                     |             | BIDDER/ :<br>VENDOR      |                                       |                      | QUALITY PLAN<br>NUMBER PED-506-00-Q-007, REV-03 |                  |                               | SPECIFICATION :<br>TITLE    |    |                                                      |
|                                                                                   |                                                                                                          |                                     |             | SYSTEM                   |                                       |                      | ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)  |                  |                               | SECTION VOLUME III          |    |                                                      |
| SL. NO.                                                                           | COMPONENT/OPERATION                                                                                      | CHARACTERISTIC CHECK                | CAT.        | TYPE/<br>METHOD OF CHECK | EXTENT OF CHECK                       | REFERENCE DOCUMENT   | ACCEPTANCE NORM                                 | FORMAT OF RECORD | AGENCY                        |                             |    | REMARKS                                              |
| 1                                                                                 | 2                                                                                                        | 3                                   | 4           | 5                        | 6                                     | 7                    | 8                                               | 9                | 10                            | 11                          | 12 | 13                                                   |
| 1.5                                                                               | SHAFT<br>(FORGED OR ROLLED)                                                                              | 1. SURFACE COND.                    | MA          | VISUAL                   | 100%                                  | -                    | FREE FROM VISUAL DEFECTS                        | -DO-             | 3                             | -                           | -  | VENDOR'S APPROVAL IDENTIFICATION SHALL BE MAINTAINED |
|                                                                                   |                                                                                                          | 2. CHEM. & PHYSICAL PROPERTIES      | MA          | CHEM. & PHYSICAL TESTS   | 1/HEAT NO. OR HEAT TREATMENT BATCH NO | MFG. DRG. SPEC.      | RELEVANT IS                                     | SUPPLIER'S TC    | 3                             | -                           | 2  |                                                      |
|                                                                                   |                                                                                                          | 3. DIMENSIONS                       | MA          | MEASUREMENT              | 100%                                  | -DO-                 | MANUFR'S DRG.                                   | LOG BOOK         | 3                             | -                           | 2  |                                                      |
|                                                                                   |                                                                                                          | 4.INTERNAL FLAWS                    | CR          | UT                       | -DO-                                  | ASTM-A388            | MANUFR'S SPEC. BHEL SPEC.                       | -DO-             | 3                             | 2                           | 1  |                                                      |
| 1.6                                                                               | SPACE HEATERS, CONNECTORS, TERMINAL BLOCKS, CABLES, CABLE LUGS, CARBON BRUSH TEMP. DETECTORS, RTD, BTD'S | 1. MAKE & RATING                    | MA          | VISUAL                   | -DO-                                  | MANUFR'S DRG. SPEC.  | MANUFR'S DRG. SPEC.                             | -DO-             | 3                             | -                           | 2  | FOR DIA OF 55 MM & ABOVE                             |
|                                                                                   |                                                                                                          | 2. PHYSICAL COND.                   | MA          | -DO-                     | -DO-                                  | -                    | NO PHYS. DAMAGE, NO ELECTRICAL DISCONTINUITY    | -DO-             | 3                             | -                           | 2  |                                                      |
|                                                                                   |                                                                                                          | 3.DIMENSIONS (WHEREVER APPLICABLE)  | MA          | MEASUREMENT              | SAMPLE                                | MANUFR'S DRG./ SPEC. | MANUFR'S DRG. / SPEC.                           | -DO-             | 3                             | -                           | 2  |                                                      |
|                                                                                   |                                                                                                          | 4.PERFORMANCE/ CALIBRATION          | MA          | TEST                     | 100%                                  | -DO-                 | -DO-                                            | INSP. REPORT     | 3                             | -                           | 2  |                                                      |
| BHEL                                                                              |                                                                                                          |                                     | PARTICULARS |                          |                                       | BIDDER/VENDOR        |                                                 |                  |                               |                             |    |                                                      |
|                                                                                   |                                                                                                          |                                     | NAME        |                          |                                       |                      |                                                 |                  |                               |                             |    |                                                      |
|                                                                                   |                                                                                                          |                                     | SIGNATURE   |                          |                                       |                      |                                                 |                  |                               |                             |    |                                                      |
|                                                                                   |                                                                                                          |                                     | DATE        |                          |                                       |                      |                                                 |                  | BIDDER'S/VENDORS COMPANY SEAL |                             |    |                                                      |

|                                                                                   |                                                                                    |                                                                                       |                        |                                                      |                                |                                                            |                                                                            |                                                        |                               |                     |                     |                                                                                                                                                                                                                                                          |
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|  |                                                                                    | <b>QUALITY PLAN</b><br><br>SHEET 3 OF 9                                               |                        | CUSTOMER :                                           |                                | PROJECT                                                    |                                                                            |                                                        | SPECIFICATION :               |                     |                     |                                                                                                                                                                                                                                                          |
|                                                                                   |                                                                                    |                                                                                       |                        | BIDDER/ VENDOR :                                     |                                | TITLE                                                      |                                                                            |                                                        | NUMBER :                      |                     |                     |                                                                                                                                                                                                                                                          |
|                                                                                   |                                                                                    |                                                                                       |                        | SYSTEM                                               |                                | QUALITY PLAN                                               |                                                                            |                                                        | SPECIFICATION :               |                     |                     |                                                                                                                                                                                                                                                          |
|                                                                                   |                                                                                    |                                                                                       |                        | ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)       |                                | NUMBER PED-506-00-Q-007, REV-03                            |                                                                            |                                                        | TITLE                         |                     |                     |                                                                                                                                                                                                                                                          |
|                                                                                   |                                                                                    |                                                                                       |                        |                                                      |                                | SECTION                                                    |                                                                            |                                                        | VOLUME III                    |                     |                     |                                                                                                                                                                                                                                                          |
| SL. NO.                                                                           | COMPONENT/OPERATION                                                                | CHARACTERISTIC CHECK                                                                  | CAT.                   | TYPE/ METHOD OF CHECK                                | EXTENT OF CHECK                | REFERENCE DOCUMENT                                         | ACCEPTANCE NORM                                                            | FORMAT OF RECORD                                       | AGENCY                        |                     |                     | REMARKS                                                                                                                                                                                                                                                  |
|                                                                                   |                                                                                    |                                                                                       |                        |                                                      |                                |                                                            |                                                                            |                                                        | P                             | W                   | V                   |                                                                                                                                                                                                                                                          |
| 1                                                                                 | 2                                                                                  | 3                                                                                     | 4                      | 5                                                    | 6                              | 7                                                          | 8                                                                          | 9                                                      | 10                            |                     |                     | 11                                                                                                                                                                                                                                                       |
| 1.7                                                                               | OTHER INSULATING MATERIALS LIKE SLEEVES, BINDINGS CORDS, PAPERS, PRESS BOARDS ETC. | 1. SURFACE COND. ETC.<br><br>2. OTHER CHARACTERISTICS                                 | MA<br><br>MA           | VISUAL<br><br>TEST                                   | 100%<br><br>SAMPLE             | -<br><br>MANUF'S SPEC.                                     | NO VISUAL DEFECTS<br><br>MANUF'S SPEC.                                     | INSPT. REPORT<br><br>LOG BOOK AND OR SUPPLIER'S TC     | 3<br><br>3                    | -<br><br>-          | 2<br><br>2          | FOR MV MOTOR INSULATION/VARNISH THICKNESS SHALL BE MORE THAN THE BURS HEIGHT<br><br><br>* MOTOR MANUFACTURER TO CONDUCT VISUAL CHECK FOR SURFACE FINISH ON RANDOM BASIS (10% SAMPLE) AT HIS WORKS AND MAINTAIN RECORD FOR VERIFICATION BY BHEL/CUSTOMER. |
| 1.8                                                                               | SHEET STAMPING (PUNCHED)                                                           | 1. SURFACE COND.<br><br>2.DIMENSIONS INCLUDING BURS HEIGHT<br><br>3. ACCEPTANCE TESTS | MA<br><br>MA<br><br>MA | VISUAL<br><br>MEASUREMENT<br><br>ELECT. & MECH TESTS | 100%<br><br>SAMPLE<br><br>-DO- | -<br><br>MANUFR'S DRG. .<br><br>MANUF'S SPEC./ RELEVANT IS | NO VISUAL DEFECTS (FREE FROM BURS)<br><br>MANUFR'S DRG.<br><br>RELEVANT IS | LOG BOOK<br><br>-DO-<br><br>SUPPLIER'S TC              | 3<br><br>3<br><br>3           | -<br><br>-<br><br>- | -<br><br>2<br><br>2 |                                                                                                                                                                                                                                                          |
| 1.9                                                                               | CONDUCTORS                                                                         | 1. SURFACE FINISH<br><br>2.ELECT. PROP. & MECH. PROP                                  | MA<br><br>MA           | VISUAL<br><br>ELECT. & MECH.TEST                     | 100%<br><br>SAMPLES            | -<br><br>RELEVANT IS/ BS OR OTHER STANDARDS                | FREE FROM VISUAL DEFECTS<br><br>RELEVANT IS/ BS OR OTHER STANDARDS         | LOG BOOK<br><br>SUPPLIERS TC & VENDOR'S INSPN. REPORTS | 3*<br><br>3                   | -<br><br>-          | 2*<br><br>2         |                                                                                                                                                                                                                                                          |
| BHEL                                                                              |                                                                                    |                                                                                       | PARTICULARS            |                                                      |                                | BIDDER/VENDOR                                              |                                                                            |                                                        |                               |                     |                     |                                                                                                                                                                                                                                                          |
|                                                                                   |                                                                                    |                                                                                       | NAME                   |                                                      |                                |                                                            |                                                                            |                                                        |                               |                     |                     |                                                                                                                                                                                                                                                          |
|                                                                                   |                                                                                    |                                                                                       | SIGNATURE              |                                                      |                                |                                                            |                                                                            |                                                        |                               |                     |                     |                                                                                                                                                                                                                                                          |
|                                                                                   |                                                                                    |                                                                                       | DATE                   |                                                      |                                |                                                            |                                                                            |                                                        | BIDDER'S/VENDORS COMPANY SEAL |                     |                     |                                                                                                                                                                                                                                                          |

|  |                                 | <b>QUALITY PLAN</b><br><br>SHEET 4 OF 9 | CUSTOMER :       |                       |                 | PROJECT TITLE                                  |                                            |                  | SPECIFICATION : NUMBER : |    |    |         |
|-----------------------------------------------------------------------------------|---------------------------------|-----------------------------------------|------------------|-----------------------|-----------------|------------------------------------------------|--------------------------------------------|------------------|--------------------------|----|----|---------|
|                                                                                   |                                 |                                         | BIDDER/ VENDOR : |                       |                 | QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03   |                                            |                  | SPECIFICATION : TITLE    |    |    |         |
|                                                                                   |                                 |                                         | SYSTEM           |                       |                 | ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV) |                                            |                  | SECTION VOLUME III       |    |    |         |
| SL. NO.                                                                           | COMPONENT/OPERATION             | CHARACTERISTIC CHECK                    | CAT.             | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT                             | ACCEPTANCE NORM                            | FORMAT OF RECORD | AGENCY                   |    |    | REMARKS |
| 1                                                                                 | 2                               | 3                                       | 4                | 5                     | 6               | 7                                              | 8                                          | 9                | 10                       | 11 | 12 |         |
| 1.10                                                                              | BEARINGS                        | 3.DIMENSIONS                            | MA               | MEASUREMENT           | -DO-            | -DO-                                           | -DO-                                       | Log Book         | 3                        | -  | 2  |         |
|                                                                                   |                                 | 1.MAKE & TYPE                           | MA               | VISUAL                | 100%            | MANFR'S DRG./ APPROVED DATASHEET               | MANFR'S DRG./ APPROVED DATASHEET           | -DO-             | 3                        | -  | 2  |         |
|                                                                                   |                                 | 2.DIMENSIONS                            | MA               | MEASUREMENT           | SAMPLE          | BHEL DATA SHEET                                | BHEL DATA SHEET BEARING MANUF'S CATALOGUES | -DO-             | 3                        | -  | 2  |         |
|                                                                                   |                                 | 3.SURFACE FINISH                        | MA               | VISUAL                | 100%            | -                                              | FREE FROM VISUAL DEFECTS                   | -DO-             | 3                        | -  | 2  |         |
| 1.11                                                                              | SLIP RING (WHEREVER APPLICABLE) | 1.SURFACE COND.                         | MA               | VISUAL                | 100%            | -                                              | -DO-                                       | -DO-             | 3                        | -  | -  |         |
|                                                                                   |                                 | 2.DIMENSIONS                            | MA               | MEASUREMENT           | SAMPLE          | MANUF'S DRG                                    | MANUF'S DRG                                | -DO-             | 3                        | -  | -  |         |
|                                                                                   |                                 | 3.TEMP.WITH-STAND CAPACITY              | MA               | ELECT.TEST            | -DO-            | MANUF'S SPEC./ BHEL SPEC.                      | MANUF'S SPEC./ BHEL SPEC.                  | -DO-             | 3                        | -  | 2  |         |
|                                                                                   |                                 | 4.HV/IR                                 | MA               | -DO-                  | 100%            | -DO-                                           | -DO-                                       | -DO-             | 3                        | -  | 2  |         |
| 1.12                                                                              | OIL SEALS & GASKETS             | 1.MATERIAL OF GASKET                    | MA               | VISUAL                | 100%            | MANUF'S DRG/SPECS                              | MANUF'S DRG./ SPECS.                       | -DO-             | 3                        | -  | -  |         |
|                                                                                   |                                 | 2.SURFACE COND.                         | MA               | VISUAL                | 100%            | -                                              | FREE FROM VISUAL DEFECTS                   | -DO-             | 3                        | -  | -  |         |
|                                                                                   |                                 | 3.DIMENSIONS                            | MA               | MEASUREMENT           | SAMPLE          | MANUF'S DRG                                    | MANUF'S DRG                                | -DO-             | 3                        | -  | -  |         |
| BHEL                                                                              |                                 |                                         | PARTICULARS      |                       |                 | BIDDER/VENDOR                                  |                                            |                  |                          |    |    |         |
|                                                                                   |                                 |                                         | NAME             |                       |                 |                                                |                                            |                  |                          |    |    |         |
|                                                                                   |                                 |                                         | SIGNATURE        |                       |                 |                                                |                                            |                  |                          |    |    |         |
|                                                                                   |                                 |                                         | DATE             |                       |                 |                                                |                                            |                  |                          |    |    |         |
| BIDDER'S/VENDORS COMPANY SEAL                                                     |                                 |                                         |                  |                       |                 |                                                |                                            |                  |                          |    |    |         |

|  |                                                         | QUALITY PLAN                                  |             | CUSTOMER :                |                 |                                          | PROJECT TITLE                                   |                  |                               | SPECIFICATION :<br>NUMBER : |   |            |
|-----------------------------------------------------------------------------------|---------------------------------------------------------|-----------------------------------------------|-------------|---------------------------|-----------------|------------------------------------------|-------------------------------------------------|------------------|-------------------------------|-----------------------------|---|------------|
|                                                                                   |                                                         |                                               |             | BIDDER/ VENDOR :          |                 |                                          | QUALITY PLAN<br>NUMBER PED-506-00-Q-007, REV-03 |                  |                               | SPECIFICATION :<br>TITLE    |   |            |
|                                                                                   |                                                         | SHEET 5 OF 9                                  |             | SYSTEM                    |                 |                                          | ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)  |                  |                               | SECTION                     |   | VOLUME III |
| SL. NO.                                                                           | COMPONENT/OPERATION                                     | CHARACTERISTIC CHECK                          | CAT.        | TYPE/ METHOD OF CHECK     | EXTENT OF CHECK | REFERENCE DOCUMENT                       | ACCEPTANCE NORM                                 | FORMAT OF RECORD | AGENCY                        |                             |   | REMARKS    |
| 1                                                                                 | 2                                                       | 3                                             | 4           | 5                         | 6               | 7                                        | 8                                               | 9                | P                             | W                           | V | 11         |
| 2.0                                                                               | IN PROCESS                                              |                                               |             |                           |                 |                                          |                                                 |                  |                               |                             |   |            |
| 2.1                                                                               | STATOR FRAME WELDING<br>(IN CASE OF FABRICATED STATOR ) | 1.WORKMANSHIP & CLEANNES                      | MA          | VISUAL                    | 100%            | -DO-                                     | GOOD FINISH                                     | LOG BOOK         | 3/2                           | 2                           | - |            |
|                                                                                   |                                                         | 2.DIMENSIONS                                  | MA          | MEASUREMENT               | -DO-            | MANUF'S DRG                              | MANUF'S DRG                                     | -DO-             | 2                             | -                           | - |            |
| 2.2                                                                               | MACHINING                                               | 1.FINISH                                      | MA          | VISUAL                    | 100%            | -DO-                                     | GOOD FINISH                                     | LOG BOOK         | 2                             | -                           | - |            |
|                                                                                   |                                                         | 2.DIMENSIONS                                  | MA          | MEASUREMENT               | -DO-            | MANUF'S DRG                              | MANUF'S DRG                                     | -DO-             | 2                             | -                           | - |            |
|                                                                                   |                                                         | 3.SHAFT SURFACE FLOWS                         | MA          | PT                        | -DO-            | RELEVANT SPEC./ ASTM-E165                | MANUF'S SPEC./ BHEL SPEC./                      | -DO-             | 2                             | -                           | 1 |            |
| 2.3                                                                               | PAINTING                                                | 1.SURFACE PREPARATION                         | MA          | VISUAL                    | 100%            | MANUF'S SPEC./BHEL SPEC./ RELEVANT STAND | BHEL SPEC. SAME AS COL.7                        | LOG BOOK         | 2                             | -                           | - |            |
|                                                                                   |                                                         | 2.PAINT THICKNESS (BOTH PRIMER & FINISH COAT) | MA          | MEASUREMENT BY ELCOMETER  | SAMPLE          | -DO-                                     | -DO-                                            | -DO-             | 2                             | -                           | - |            |
|                                                                                   |                                                         | 3.SHADE                                       | MA          | VISUAL                    | -DO-            | -DO-                                     | -DO-                                            | Log Book         | 2                             | -                           | - |            |
|                                                                                   |                                                         | 4.ADHESION                                    | MA          | CROSS CUTTING & TAPE TEST | -DO-            | -DO-                                     | -DO-                                            | Log Book         | 2                             | -                           | - |            |
| BHEL                                                                              |                                                         |                                               | PARTICULARS |                           |                 | BIDDER/VENDOR                            |                                                 |                  |                               |                             |   |            |
|                                                                                   |                                                         |                                               | NAME        |                           |                 |                                          |                                                 |                  |                               |                             |   |            |
|                                                                                   |                                                         |                                               | SIGNATURE   |                           |                 |                                          |                                                 |                  |                               |                             |   |            |
|                                                                                   |                                                         |                                               | DATE        |                           |                 |                                          |                                                 |                  | BIDDER'S/VENDORS COMPANY SEAL |                             |   |            |

|  |                     | <b>QUALITY PLAN</b>                    |             | CUSTOMER :            |                 |                           | PROJECT TITLE                                  |                  |                               | SPECIFICATION : NUMBER : |   |                                                         |
|-----------------------------------------------------------------------------------|---------------------|----------------------------------------|-------------|-----------------------|-----------------|---------------------------|------------------------------------------------|------------------|-------------------------------|--------------------------|---|---------------------------------------------------------|
|                                                                                   |                     |                                        |             | BIDDER/ VENDOR :      |                 |                           | QUALITY PLAN NUMBER PED-506-00-Q-007, REV-03   |                  |                               | SPECIFICATION : TITLE    |   |                                                         |
|                                                                                   |                     |                                        |             | SYSTEM                |                 |                           | ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV) |                  |                               | SECTION VOLUME III       |   |                                                         |
| SL. NO.                                                                           | COMPONENT/OPERATION | CHARACTERISTIC CHECK                   | CAT.        | TYPE/ METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT        | ACCEPTANCE NORM                                | FORMAT OF RECORD | AGENCY                        |                          |   | REMARKS                                                 |
| 1                                                                                 | 2                   | 3                                      | 4           | 5                     | 6               | 7                         | 8                                              | 9                | P                             | W                        | V | 11                                                      |
| 2.4                                                                               | SHEET STACKING      | 1.COMPLETENESS                         | MA          | MEASUREMENT           | SAMPLE          | MANUFR'S SPEC.            | MANUFR'S SPEC.                                 | Log Book         | 2                             | -                        | - | (FOR MOTORS OF 2MW AND ABOVE)<br>* ON 10% RANDOM SAMPLE |
|                                                                                   |                     | 2.COMPRESSION & TIGHTENING             | MA          | MEASUREMENT           | 100%            | -DO-                      | -DO-                                           | Log Book         | 2                             | -                        | - |                                                         |
|                                                                                   |                     | 3.CORE LOSS & HOTSPOT                  | MA          | ELECT.TEST            | -DO-            | -DO-                      | -DO-                                           | Log Book         | 2                             | 1*                       | 1 |                                                         |
| 2.5                                                                               | WINDING             | 1.COMPLETENESS                         | CR          | VISUAL                | 100%            | MANUFR'S SPEC./BHEL SPEC. | MANUFR'S SPEC./BHEL SPEC.                      | Log Book         | 2                             | -                        | - | FOR MV MOTOR                                            |
|                                                                                   |                     | 2.CLEANLINESS                          | CR          | -DO-                  | -DO-            | -DO-                      | -DO-                                           | Log Book         | 2                             | -                        | - |                                                         |
|                                                                                   |                     | 3.IR-HV-IR                             | CR          | ELECT. TEST           | -DO-            | -DO-                      | -DO-                                           | Log Book         | 2                             | -                        | 1 |                                                         |
|                                                                                   |                     | 4.RESISTANCE                           | CR          | -DO-                  | -DO-            | -DO-                      | -DO-                                           | Log Book         | 2                             | -                        | 1 |                                                         |
|                                                                                   |                     | 5.INTERTURN INSULATION                 | CR          | -DO-                  | -DO-            | -DO-                      | -DO-                                           | Log Book         | 2                             | -                        | - |                                                         |
|                                                                                   |                     | 6.SURGE WITH STAND AND TAN. DELTA TEST | CR          | -DO-                  | -DO-            | -DO-                      | -DO-                                           | Log Book         | 2                             | -                        | 1 |                                                         |
| 2.6                                                                               | IMPREGNATION        | 1.VISCOSCITY                           | MA          | PHY. TEST             | AT STARTING     | -DO-                      | -DO-                                           | Log Book         | 2                             | -                        | - | THREE DIPS TO BE GIVEN                                  |
|                                                                                   |                     | 2.TEMP. PRESSURE VACCUM                | MA          | PROCESS CHECK         | CONTINUOUS      | -DO-                      | -DO-                                           | Log Book         | 2                             | -                        | - |                                                         |
|                                                                                   |                     | 3.NO. OF DIPS                          | MA          | -DO-                  | -DO-            | -DO-                      | -DO-                                           | Log Book         | 2                             | -                        | 1 |                                                         |
| BHEL                                                                              |                     |                                        | PARTICULARS |                       |                 | BIDDER/VENDOR             |                                                |                  |                               |                          |   |                                                         |
|                                                                                   |                     |                                        | NAME        |                       |                 |                           |                                                |                  |                               |                          |   |                                                         |
|                                                                                   |                     |                                        | SIGNATURE   |                       |                 |                           |                                                |                  |                               |                          |   |                                                         |
|                                                                                   |                     |                                        | DATE        |                       |                 |                           |                                                |                  |                               |                          |   |                                                         |
|                                                                                   |                     |                                        |             |                       |                 |                           |                                                |                  | BIDDER'S/VENDORS COMPANY SEAL |                          |   |                                                         |

|         |                           | QUALITY PLAN                                                   |             | CUSTOMER :            |                 |                       | PROJECT TITLE                                   |                  | SPECIFICATION :<br>NUMBER : |   |            |                                |    |
|---------|---------------------------|----------------------------------------------------------------|-------------|-----------------------|-----------------|-----------------------|-------------------------------------------------|------------------|-----------------------------|---|------------|--------------------------------|----|
|         |                           |                                                                |             | BIDDER/ :<br>VENDOR   |                 |                       | QUALITY PLAN<br>NUMBER PED-506-00-Q-007, REV-03 |                  | SPECIFICATION :<br>TITLE    |   |            |                                |    |
|         |                           | SHEET 7 OF 9                                                   |             | SYSTEM                |                 |                       | ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)  |                  | SECTION                     |   | VOLUME III |                                |    |
| SL. NO. | COMPONENT/OPERATION       | CHARACTERISTIC CHECK                                           | CAT.        | TYPE/METHOD OF CHECK  | EXTENT OF CHECK | REFERENCE DOCUMENT    | ACCEPTANCE NORM                                 | FORMAT OF RECORD | AGENCY                      |   |            | REMARKS                        |    |
| 1       | 2                         | 3                                                              | 4           | 5                     | 6               | 7                     | 8                                               | 9                | 10                          | P | W          | V                              | 11 |
| 2.7     | COMPLETE STATOR ASSEMBLY  | 4.DURATION                                                     | MA          | -DO-                  | -DO-            | -DO-                  | -DO-                                            | Log Book         | 2                           | - | 1          | VERIFICATION FOR MV MOTOR ONLY |    |
| 2.8     | BRAZING/COMPRESSION JOINT | 1.COMPACTNESS & CLEANLINESS                                    | MA          | VISUAL                | 100%            | -DO-                  | -DO-                                            | Log Book         | 2                           | - | -          |                                |    |
| 2.9     | COMPLETE ROTOR ASSEMBLY   | 1.COMPLETENESS                                                 | CR          | -DO-                  | -DO-            | -DO-                  | -DO-                                            | Log Book         | 2                           | - | -          |                                |    |
|         |                           | 2.SOUNDNESS                                                    | CR          | MALLET TEST & UT      | -DO-            | -DO-                  | -DO-                                            | Log Book         | 2                           |   | 1          |                                |    |
|         |                           | 3.HV                                                           | MA          | ELECT. TEST           | -DO-            | -DO-                  | -DO-                                            | Log Book         | 2                           |   | 1          |                                |    |
| 2.10    | ASSEMBLY                  | 1.RESIDUAL UNBALANCE                                           | CR          | DYN. BALANCE          | -DO-            | MFG SPEC./ ISO 1940   | MFG. DWG.                                       | Log Book         | 2                           |   | 1          |                                |    |
|         |                           | 2.SOUNDNESS OF DIE CASTING                                     | CR          | ELECT. (GROWLER TEST) | -DO-            | MFG. SPEC.            | MFG. SPEC.                                      | Log Book         | 2                           |   | 1          |                                |    |
| 2.10    | ASSEMBLY                  | 1.ALIGNMENT                                                    | MA          | MEAS.                 | -DO-            | -DO-                  | -DO-                                            | Log Book         | 2                           | - | -          |                                |    |
|         |                           | 2.WORKMANSHIP                                                  | MA          | VISUAL                | -DO-            | -DO-                  | -DO-                                            | Log Book         | 2                           | - | -          |                                |    |
|         |                           | 3.AXIAL PLAY                                                   | MA          | MEAS.                 | -DO-            | -DO-                  | -DO-                                            | Log Book         | 2                           | - | 1          |                                |    |
|         |                           | 4.DIMENSIONS                                                   | MA          | -DO-                  | -DO-            | MFG.DRG./ MFG SPEC.   | MFG. DRG/ RELEVANT IS                           | Log Book         | 2                           | - | -          |                                |    |
|         |                           | 5.CORRECTNESS, COMPLETENESS TERMINATIONS/ MARKING/ COLOUR CODE | MA          | VISUAL                | 100%            | MFG SPEC. RELEVANT IS | MFG SPEC. RELEVANT IS                           | Log Book         | 2                           | - | -          |                                |    |
|         |                           | 6. RTD, BTD & SPACE HEATER MOUNTING.                           | MA          | VISUAL                | 100%            | MFG SPEC. RELEVANT IS | MFG SPEC. RELEVANT IS                           | Log Book         | 2                           |   | 1          |                                |    |
| BHEL    |                           |                                                                | PARTICULARS |                       | BIDDER/VENDOR   |                       |                                                 |                  |                             |   |            |                                |    |
|         |                           |                                                                | NAME        |                       |                 |                       |                                                 |                  |                             |   |            |                                |    |
|         |                           |                                                                | SIGNATURE   |                       |                 |                       |                                                 |                  |                             |   |            |                                |    |
|         |                           |                                                                | DATE        |                       |                 |                       |                                                 |                  |                             |   |            |                                |    |
|         |                           |                                                                |             |                       |                 |                       |                                                 |                  |                             |   |            | BIDDER'S/VENDORS COMPANY SEAL  |    |

|         |                     |                                                          |             |                                   |                 |                                |                                       |                               |                 |                |            |                                                              |
|---------|---------------------|----------------------------------------------------------|-------------|-----------------------------------|-----------------|--------------------------------|---------------------------------------|-------------------------------|-----------------|----------------|------------|--------------------------------------------------------------|
|         |                     | <b>QUALITY PLAN</b><br>SHEET 8 OF 9                      |             | CUSTOMER :                        |                 | PROJECT                        |                                       |                               | SPECIFICATION : |                |            |                                                              |
|         |                     |                                                          |             | BIDDER/ :                         |                 | TITLE                          |                                       |                               | NUMBER :        |                |            |                                                              |
|         |                     |                                                          |             | VENDOR                            |                 | QUALITY PLAN                   |                                       |                               | SPECIFICATION : |                |            |                                                              |
| SYSTEM  |                     | NUMBER PED-506-00-Q-007, REV-03                          |             |                                   | TITLE           |                                |                                       | SECTION                       |                 |                | VOLUME III |                                                              |
| SL. NO. | COMPONENT/OPERATION | CHARACTERISTIC CHECK                                     | CAT.        | TYPE/METHOD OF CHECK              | EXTENT OF CHECK | REFERENCE DOCUMENT             | ACCEPTANCE NORM                       | FORMAT OF RECORD              | AGENCY          |                |            | REMARKS                                                      |
|         |                     |                                                          |             |                                   |                 |                                |                                       |                               | P               | W              | V          |                                                              |
| 1       | 2                   | 3                                                        | 4           | 5                                 | 6               | 7                              | 8                                     | 9                             | 10              |                |            | 11                                                           |
| 3.0     | TESTS               | 1.TYPE TESTS INCLUDING SPECIAL TESTS AS PER BHEL SPEC.   | MA          | ELECT.TEST                        | 1/TYPE/SIZE     | IS-325/ BHEL SPEC./ DATA SHEET | IS-325/ BHEL SPEC./ DATA SHEET        | TEST REPORT                   | 2               | 1*             | 1          | * NOTE - 1                                                   |
|         |                     | 2.ROUTINE TESTS INCLUDING SPECIAL TEST AS PER BHEL SPEC. | MA          | -DO-                              | 100%            | -DO-                           | -DO-                                  | -DO-                          | 2               | 1 <sup>s</sup> | 1          | \$ NOTE - 2                                                  |
|         |                     | 3.VIBRATION & NOISE LEVEL                                | MA          | -DO-                              | 100%            | IS-12075 & IS-12065            | IS-12075 & IS-12065                   | -DO-                          | 2               | 1 <sup>s</sup> | 1          | \$ NOTE - 2                                                  |
|         |                     | 4.OVERALL DIMENSIONS AND ORIENTATION                     | MA          | MEASUREMENT & VISUAL              | 100%            | APPROVED DRG/DATA SHEET        | APPROVED DRG/DATA SHEET & RELEVANT IS | INSPC. REPORT                 | 2               | 1              | -          |                                                              |
|         |                     | 5.DEGREE OF PROTECTION                                   | MA          | ELECT. & MECH. TEST               | 1/TYPE/ SIZE    | RELEVANT IS                    | BHEL SPEC. AND DATA SHEET             | TC                            | 2               | -              | 1          | TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3              |
|         |                     | 6. MEASUREMENT OF RESISTANCE OF RTD & BTD                | MA          | -DO-                              | 100%            | -DO-                           | -DO-                                  | -DO-                          | 2               | 1 <sup>s</sup> | 1          | \$ NOTE - 2                                                  |
|         |                     | 7. MEASUREMENT OF RESISTANCE, IR OF SPACE HEATER         | MA          | -DO-                              | 100%            | -DO-                           | -DO-                                  | -DO-                          | 2               | 1 <sup>s</sup> | 1          | \$ NOTE - 2                                                  |
|         |                     | 8. NAMEPLATE DETAILS                                     | MA          | VISUAL                            | 100%            | IS-325 & DATA SHEET            | IS-325 & DATA SHEET                   | INSPC. REPORT                 | 2               | 1 <sup>s</sup> | 1          | \$ NOTE - 2                                                  |
|         |                     | 9.EXPLOSION FLAME PROOF NESS (IF SPECIFIED)              | MA          | EXPLOSION FLAME PROOF TEST        | 1/TYPE          | IS-3682 IS-8239 IS-8240        | IS-3682 IS-8239 IS-8240               | TC                            | 2               | -              | 1          | TC FROM AN INDEPENDENT LABORATORY, REFER NOTE-3              |
|         |                     | 10. PAINT SHADE, THICKNESS & FINISH                      | MA          | VISUAL & MEASUREMENT BY ELKOMETER | SAMPLE          | BHEL SPEC. & DATA SHEET        | BHEL SPEC. & DATA SHEET               | TC                            | 2               | 1 <sup>s</sup> | 1          | SAMPLING PLAN TO BE DECIDED BY INSPECTION AGENCY \$ NOTE - 2 |
| BHEL    |                     |                                                          | PARTICULARS |                                   | BIDDER/VENDOR   |                                |                                       |                               |                 |                |            |                                                              |
|         |                     |                                                          | NAME        |                                   |                 |                                |                                       |                               |                 |                |            |                                                              |
|         |                     |                                                          | SIGNATURE   |                                   |                 |                                |                                       |                               |                 |                |            |                                                              |
|         |                     |                                                          | DATE        |                                   |                 |                                |                                       | BIDDER'S/VENDORS COMPANY SEAL |                 |                |            |                                                              |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                                         |             |                          |                 |                                                 |                 |                  |                             |   |            |                               |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|-----------------------------------------|-------------|--------------------------|-----------------|-------------------------------------------------|-----------------|------------------|-----------------------------|---|------------|-------------------------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                     | <b>QUALITY PLAN</b><br><br>SHEET 9 OF 9 |             | CUSTOMER :               |                 | PROJECT<br>TITLE                                |                 |                  | SPECIFICATION :<br>NUMBER : |   |            |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                                         |             | BIDDER/ :<br>VENDOR      |                 | QUALITY PLAN<br>NUMBER PED-506-00-Q-007, REV-03 |                 |                  | SPECIFICATION :<br>TITLE    |   |            |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                                         |             | SYSTEM                   |                 | ITEM: AC ELECT. MOTORS 55 KW & ABOVE (LV & MV)  |                 |                  | SECTION                     |   | VOLUME III |                               |
| SL. NO.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | COMPONENT/OPERATION | CHARACTERISTIC CHECK                    | CAT.        | TYPE/<br>METHOD OF CHECK | EXTENT OF CHECK | REFERENCE DOCUMENT                              | ACCEPTANCE NORM | FORMAT OF RECORD | AGENCY                      |   |            | REMARKS                       |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                                         |             |                          |                 |                                                 |                 |                  | P                           | W | V          |                               |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2                   | 3                                       | 4           | 5                        | 6               | 7                                               | 8               | 9                | 10                          |   |            | 11                            |
| <p>NOTES:</p> <p>1 DEPENDING UPON THE SIZE AND CRITICALLY, WITNESSING BY BHEL SHALL BE DECIDED.</p> <p>2 ROUTINE TESTS ON 100% MOTORS SHALL BE DONE BY THE VENDOR. HOWEVER, BHEL SHALL WITNESS ROUTINE TESTS ON RANDOM SAMPLES. THE SAMPLING PLAN SHALL BE MUTUALLY AGREED UPON.</p> <p>3 IN CASE TEST CERTIFICATES FOR THESE TESTS ON SIMILAR TYPE, SIZE AND DESIGN OF MOTOR FROM INDEPENDENT LABORATORY ARE AVAILABLE, THESE TEST MAY NOT BE REPEATED.</p> <p>4 WHEREVER CUSTOMER IS INVOLVED IN INSPECTION, AGENCY (1) SHALL MEAN BHEL AND CUSTOMERS BOTH TOGETHER.</p> <p><u>Legends for Inspection agency</u></p> <p>1. BHEL/CUSTOMER<br/>2. VENDOR (MOTOR MANUFACTURER)<br/>3. SUB-VENDOR (RAW MATERIAL/COMPONENTS SUPPLIER)</p> <p>P. PERFORM<br/>W. WITNESS<br/>V. VERIFY</p> |                     |                                         |             |                          |                 |                                                 |                 |                  |                             |   |            |                               |
| BHEL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                     |                                         | PARTICULARS |                          |                 | BIDDER/VENDOR                                   |                 |                  |                             |   |            |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                                         | NAME        |                          |                 |                                                 |                 |                  |                             |   |            |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                                         | SIGNATURE   |                          |                 |                                                 |                 |                  |                             |   |            |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                                         | DATE        |                          |                 |                                                 |                 |                  |                             |   |            |                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                     |                                         |             |                          |                 |                                                 |                 |                  |                             |   |            | BIDDER'S/VENDORS COMPANY SEAL |

| COMPREHENSIVE & UPDATED LIST OF MAIN VENDORS FOR BoIs PROCURED BY ELECTRICAL, C&I, MPL & MSE TO BE USED AS APPROVED SUB-VENDORS FOR BoP/ BoI PACKAGES |            |                                  |                                   |                                                                                                             |            | APPLICABILITY OF ITEM AS PER PACKAGE |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------|------------|--------------------------------------|
| S. No.                                                                                                                                                | Deptt.     | Package                          | PMD Vendor/ Sub Vendor            | Vendor Address                                                                                              | Remarks    | COLTCS/SCS/DF/TWS                    |
| 1                                                                                                                                                     | Electrical | LV MOTORS (NON FLAME PROOF)      | ABB                               | 14, MATHURA ROAD, FARIDABAD, HARYANA-121003                                                                 | Sub vendor | YES                                  |
| 2                                                                                                                                                     | Electrical | LV MOTORS (NON FLAME PROOF)      | BHARAT BIJLEE LTD.                | BHARAT BIJLEE LIMITED, 1ST FLOOR, 7-B, RAJINDRA PARK, PUSA ROAD, NEW DELHI - 110 060.                       | Sub vendor | YES                                  |
| 3                                                                                                                                                     | Electrical | LV MOTORS (NON FLAME PROOF)      | CROMPTON GREAVES                  | 3RD FLOOR, EXPRESS BUILDING,9-10, BAHADUR SHAH ZAFAR MARG, NEAR ITO CROSSING,NEW DELHI-110002, INDIA        | Sub vendor | YES                                  |
| 4                                                                                                                                                     | Electrical | LV MOTORS (NON FLAME PROOF)      | GE-POWER                          | KAMAK TOWER, 3RD FLOOR, PLOT NO. 12-A, TVK INDUSTRIAL ESTATE, EKKADUTHANGAL, GUINDY, CHENNAI-600032         | Sub vendor | YES                                  |
| 5                                                                                                                                                     | Electrical | LV MOTORS (NON FLAME PROOF)      | KIRLOSKAR ELECTRIC CO LTD.        | P.O. BOX 5555 , MALLESWARAM WEST ,BANGALORE 560055                                                          | Sub vendor | YES                                  |
| 6                                                                                                                                                     | Electrical | LV MOTORS (NON FLAME PROOF)      | LAXMI HYDRAULICS PVT. LTD         | 129/130, INDUSTRIAL ESTATE PATIL NAGAR, HOTGI ROAD SOLAPUR-413003, MAHARASHTRA                              | Sub vendor | YES                                  |
| 7                                                                                                                                                     | Electrical | LV MOTORS (NON FLAME PROOF)      | MARATHON                          | MARATHON ELECTRIC INDIA PRIVATE LTD.SECTOR - 11, MODEL TOWN, FARIDABAD - 121006                             | Sub vendor | YES                                  |
| 8                                                                                                                                                     | Electrical | LV MOTORS (NON FLAME PROOF)      | NGEF                              | POCKET NO.10, FLAT NO. 37 & 38, EXPANDABLE DDA FLATS, NASIRPUR DWARKA, PHASE-I NEW DELHI-110 045            | Sub vendor | YES                                  |
| 9                                                                                                                                                     | Electrical | LV MOTORS (NON FLAME PROOF)      | RAJINDRA ELECT INDUSTRIES         | 14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053                                                  | Sub vendor | YES                                  |
| 10                                                                                                                                                    | Electrical | LV MOTORS (NON FLAME PROOF)      | SIEMENS                           | RC-IN I S NR DEL AREA, JIL BUILDING, TOWER-B, PLOT NO. 78, SECTOR 18, GURGAON-122015, INDIA                 | Sub vendor | YES                                  |
| 11                                                                                                                                                    | Electrical | LV MOTORS (FLAME PROOF)          | RAJINDRA ELECT INDUSTRIES         | 14 SHAH IND.ESTATE VEERA DESAI RD,ANDHERI(W) MUMBAI-400053                                                  | Sub vendor | YES                                  |
| 12                                                                                                                                                    | Electrical | JUNCTION BOXES (NON FLAME PROOF) | JASPER ENGINEERS PVT. LTD.        | A-23, SECTOR - 8, NOIDA-201301                                                                              | Sub vendor | YES                                  |
| 13                                                                                                                                                    | Electrical | JUNCTION BOXES (NON FLAME PROOF) | Electro Controls & Devices        | M/S ELECTRO CONTROLS & DEVICES, F-41, SITE-C, SURAJPUR INDUSTRIAL AREA GREATER NOIDA, UTTAR PRADESH :201308 | Sub vendor | YES                                  |
| 14                                                                                                                                                    | Electrical | JUNCTION BOXES (NON FLAME PROOF) | M/s Shrenik & Co.                 | 39A/3, PANCHRATNA INDUSTRIAL ESTATE, SARKHEJ-BAVLA ROAD, CHANGODAR, AHMEDABAD – 382 213                     | Sub vendor | YES                                  |
| 15                                                                                                                                                    | Electrical | JUNCTION BOXES (NON FLAME PROOF) | M/s PHOENIX MECANO LTD.,          | 388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115                           | Sub vendor | YES                                  |
| 16                                                                                                                                                    | Electrical | JUNCTION BOXES (NON FLAME PROOF) | Adroit Control Engineers Pvt.Ltd. | M/S ADROIT CONTROL ENGINEERS PVT.LTD. PLOT-3, KRISHNA INDL. AREA, SECTOR-25 FARIDABAD – 121004              | Sub vendor | YES                                  |
| 17                                                                                                                                                    | Electrical | JUNCTION BOXES (NON FLAME PROOF) | M/s PHOENIX MECANO LTD.,          | 388 BHARE, TALUKA MULSHI, POST GHOTAWADE, PIRANGOOT, INDUSTRIAL AREA, PUNE-412115                           | Sub vendor | YES                                  |

|    |            |                                            |                                                 |                                                                                                                                                                                   |            |     |
|----|------------|--------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|-----|
| 18 | Electrical | JUNCTION BOXES<br>(NON FLAME<br>PROOF)     | MIKA ENGINEERS                                  | BRANCH OFFICE :<br>'D'-101, DHEERAJ HERITAGE RESIDENCY<br>II,<br>SHASTRI NAGAR, SANTACRUZ (W),<br>MUMBAI 400 054.                                                                 | Sub vendor | YES |
| 19 | Electrical | JUNCTION BOXES<br>(NON FLAME<br>PROOF)     | M/s PHOENIX MECANO<br>LTD.,                     | 388 BHARE, TALUKA MULSHI, POST<br>GHOTAWADE, PIRANGOOT,<br>INDUSTRIAL AREA, PUNE-412115                                                                                           | Sub vendor | YES |
| 20 | Electrical | JUNCTION BOXES<br>(NON FLAME<br>PROOF)     | BAJAJ ELECTRICALS                               | BAJAJ ELECTRICALS LTD.<br>ENGINEERING & PROJECTS BU (NORTH)<br>3rd FLOOR, GULMOHARHOUSE,<br>COMMUNITY CENTRE 161/B-4,<br>GAUTAM NAGAR, YUSUF SARAI<br>NEW DELHI – 110049          | Sub vendor | YES |
| 21 | Electrical | JUNCTION BOXES<br>(NON FLAME<br>PROOF)     | AJMERA INDUSTRIES &<br>ENGG. WORKS              | AJMERA INDL. AND ENGG. WORKS.<br>AJMERA HOUSE, A-61 / KHAIRANE MIDC.<br>, TTC INDL. AREA, NAVI MUMBAI –<br>400705.                                                                | Sub vendor | YES |
| 22 | Electrical | JUNCTION BOXES<br>(NON FLAME<br>PROOF)     | S.B. ELECTRICAL<br>ENGINEERING<br>CORPORATION   | 03, SARDAR GRIHA BUILDING, LOHAR<br>CHAWAL, MUMBAI-400002                                                                                                                         | Sub vendor | YES |
| 23 | Electrical | JUNCTION BOXES<br>(FLAME PROOF)            | SUDHIR SWITCHGEAR                               | 305/6, APEEJAY HOUSE, 130,<br>BOMBAY SAMACHAR MARG,<br>MUMBAI - 400 023.<br>INDIA                                                                                                 | Sub vendor | YES |
| 24 | Electrical | FRP CABLE TRAYS &<br>ACCESSORIES           | EPP COMPOSITES PRIVATE<br>LIMITED               | Mr. Jayraj Shah Plot No. 2646, Kranti<br>Gate Main Road, Rajkot Phone- 02827-<br>287060 Pincode : 360021 Email :<br>vaishalijoshi@epp.co.in                                       | PMD        | YES |
| 25 | Electrical | FRP CABLE TRAYS &<br>ACCESSORIES           | SUMIP COMPOSITES<br>PVT.LTD.                    | Mr.Suhrud Shah/Mr.Pulin Shah 39-A<br>Panch Ratna Industrial Estate Sarkhej-<br>Bavla Road. Changodar Ahmedabad<br>Phone- 0271-7610701 Pincode : 382213<br>Email : sales@sumip.com | PMD        | YES |
| 26 | Electrical | FRP CABLE TRAYS &<br>ACCESSORIES           | ERCON COMPOSITES                                | Mr. Mukesh Maheshwari F-123, M.I.A.,<br>Phase-II, Basni, Jodhpur Phone- 0291-<br>2744064 Pincode : 342005 Email :<br>ercon@ercon-india.com                                        | PMD        | YES |
| 27 | Electrical | CABLE TRAY<br>SUPPORT SYSTEM -<br>BOLTABLE | PREMIER POWER<br>PRODUCTS (CAL) PVT. LTD.       | Chatterjee International Centre, 33A,<br>Jawaharlal Nehru Road, 6th Floor, Suit<br>No. - 11A, Kolkata, Phone- 9331008739<br>Pincode : 700071 Email :<br>pppdaga@airtelmail.in     | PMD        | YES |
| 28 | Electrical | CABLE TRAY<br>SUPPORT SYSTEM -<br>BOLTABLE | INDUSTRIAL PERFORATION<br>(I) PVT.LTD.          | MR. A. K. SAHA 327, R.N.GUHA ROAD,<br>DUM DUM KOLKATA Phone-<br>9830241788 Pincode : 700028 Email :<br>ipipl@cal2.vsnl.net.in                                                     | PMD        | YES |
| 29 | Electrical | CABLE TRAY<br>SUPPORT SYSTEM -<br>BOLTABLE | RATAN PROJECTS &<br>ENGINEERING CO.<br>PVT.LTD. | MR. G.D. SINGHEE/MR. MAHESH<br>SINGHEE 26, P.K. TAGORE STREET, MAIN<br>BUILDING KOLKATA Phone- 9830177331<br>Pincode : 700006 Email :<br>mahesh@ratans.com                        | PMD        | YES |
| 30 | Electrical | CABLE TRAY<br>SUPPORT SYSTEM -<br>BOLTABLE | INDMARK FORMTECH PVT.<br>LTD.                   | Mr. Narendra R. Meher J Block, Plot No.-<br>375, MIDC BHOSARI PUNE Phone- 020-<br>27130546 Pincode : 411026 Email :<br>indmarkformtech@vsnl.net                                   | PMD        | YES |

|                                                                                                           |            |              |                               |                                                                                                              |            |     |
|-----------------------------------------------------------------------------------------------------------|------------|--------------|-------------------------------|--------------------------------------------------------------------------------------------------------------|------------|-----|
| 31                                                                                                        | Electrical | CABLE GLANDS | ALLIED TRADERS & EXPORTERS    | C-124 A, SECTOR-2, NOIDA -201 301, UTTAR PRADESH, INDIA                                                      | Sub vendor | YES |
| 32                                                                                                        | Electrical | CABLE GLANDS | ARUP ENGG & FOUNDRY WORKS     | 391/119,PRINCE ANWAR SHAH ROAD, CALCUTTA-700068                                                              | Sub vendor | YES |
| 33                                                                                                        | Electrical | CABLE GLANDS | BALIGA LIGHTING EQPT.PVT.LTD. | 63A,CP RAMASWAMY ROAD, ALWARPET,P.B.No 6910, CHENNAI-600018                                                  | Sub vendor | YES |
| 34                                                                                                        | Electrical | CABLE GLANDS | COMMET BRASS PRODUCTS         | NUTAN CHEMICAL COMPOUND, WALBHAT ROAD, GOREGAON, MUMBAI-400063                                               | Sub vendor | YES |
| 35                                                                                                        | Electrical | CABLE GLANDS | DOWELLS                       | M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063. | Sub vendor | YES |
| 36                                                                                                        | Electrical | CABLE GLANDS | ELECTROMAC INDUSTRIES         | 27/28AF NEW EMPIRE IND.ESTT., R.KRISHNA MANDIR RD.JB NGR ,ANDHERI(E),MUMBAI-400059                           | Sub vendor | YES |
| 37                                                                                                        | Electrical | CABLE GLANDS | INCAB                         | HARE STREET,KOLKATA,WEST BENGAL-700001                                                                       | Sub vendor | YES |
| 38                                                                                                        | Electrical | CABLE LUGS   | DOWELLS                       | M/S. DOWELLS ELECTRICALS 47/47A, SATGURU INDUSTRIAL ESTATE. OFF AAREY ROAD, GOREGOAN (EAST). MUMBAI 400 063. | Sub vendor | YES |
| 39                                                                                                        | Electrical | CABLE LUGS   | UNIVERSAL MACHINES LTD.       | 4,B.B.D.BAG (EAST) 90,STEPHEN HOUSE,5TH FLR CALCUTTA-700001                                                  | Sub vendor | YES |
| 40                                                                                                        | Electrical | GI CONDUITS  | BIS APPROVED MAKE             |                                                                                                              | Sub vendor | YES |
|                                                                                                           |            |              |                               |                                                                                                              |            |     |
| <b>Note: No. of rows to be increased/ decreased based on the no. of entries for a particular package.</b> |            |              |                               |                                                                                                              |            |     |



TITLE:

**TECHNICAL SPECIFICATION  
SELF CLEANING STRAINER**

**STANDARD TECHNICAL REQUIREMENTS**

SPEC. NO.: **PE-TS-421-165-N004**

SECTION: **II**

SUB-SECTION: **IIC**

REV. NO. **0** DATE **20.12.2017**

SHEET **1** OF **1**

## **SUB-SECTION - IIC**

### **STANDARD TECHNICAL SPECIFICATION (C &I)**



Technical specification  
for  
**2X660 MW STPP, MAITREE-BANGLADESH**

SECTION D

REV. NO. 00

DATE : 05.12.2017

## INSTRUMENTS, JB & VALVES SPECIFICATION



Technical specification  
for  
**2X660 MW STPP, MAITREE-BANGLADESH**

SECTION D

REV. NO.

00

DATE : 05.12.2017

Kindly refer the following specified clause no. for instruments/ equipments in Section-B0 of customer's General Technical Specification:

- |                                  |              |
|----------------------------------|--------------|
| <b>1.1.</b> Control cubicles     | - B0.6.19.4  |
| <b>1.2.</b> Junction boxes       | - B0.6.19.5  |
| <b>1.3.</b> Transmitters         | - B0.6.19.8  |
| <b>1.4.</b> Pressure measurement | - B0.6.19.10 |
| <b>1.5.</b> Actuators            | - B0.6.19.16 |



Technical specification  
for  
2X660 MW STPP, MAITREE-BANGLADESH

SECTION D

REV. NO.

00

DATE : 05.12.2017

**MEASURING INSTRUMENTS (PRIMARY AND SECONDARY)**

- 1.1.** Measuring instruments / equipment and subsystems offered by the Bidder shall be from reputed experienced manufacturers of specified type and range of equipment. The instrumentation vendor shall be subject to BHEL's / customer's approval. Further, all instruments shall be of proven reliability, accuracy, repeatability requiring a minimum of maintenance. All instrumentation equipment and accessories under this specification shall be furnished as per technical specifications, ranges, makes / numbers as approved by BHEL / customer during detailed engineering.
- 1.2.** Every panel-mounted instrument, requiring power supply, shall be provided with a pair of easily replaceable glass cartridge fuses of suitable rating. Every instrument shall be provided with a grounding terminal and shall be suitably connected to the panel grounding bus.
- 1.3.** All local gauges as well as transmitters, sensors and switches for parameters like pressure, temperature etc. as required for the safe and efficient operation and maintenance under the scope of specification shall be provided. The necessary root valves, impulse piping, drain cock, gauge-zeroing cocks, valve manifolds and all the other accessories required for mounting / erection of these local instruments shall be furnished even if not specifically asked for. The proposal shall include the necessary cables, flexible conduits, junction boxes and accessories for the above purpose. Double root valves shall be provided for all pressure tapping where the pressure exceeds 40 Kg / Cm<sup>2</sup>.
- 1.4.** Instruments envisaged for sea water application shall be provided with wetted parts made of Monel / Hastelloy C.
- 1.5.** All instruments shall be provided with durable epoxy coating for housing and all exposed surfaces of the instruments.



Technical specification  
for  
**2X660 MW STPP, MAITREE-BANGLADESH**

SECTION D

REV. NO.

00

DATE : 05.12.2017

**1. SPECIFICATION FOR PR. GAUGE, D.P. GAUGE, TEMP. GAUGE AND LEVEL GAUGE**

| Sl. No. | Features                     | Essential / Minimum Requirements                                                                                 |                                                                                                      |                                                                                                                             |
|---------|------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|
|         |                              | Pr. Gauge / D.P. Gauge                                                                                           | Temp. Gauge                                                                                          | Level Gauge                                                                                                                 |
| 1       | Sensing Element and Material | Bourdon for high pressure, Diaphragm / Bellow for low pr. of 316 SS                                              | Mercury in steel below 450 Deg.C and inert gas actuated for above 450 Deg.C of SS bulb and capillary | Tempered toughened Borosilicate gauge glass steel armoured reflex or transparent type.                                      |
| 2       | Body material                | Die-cast aluminium                                                                                               | Die-cast aluminium                                                                                   | Forged carbon steel 304 SS                                                                                                  |
| 3       | Dial size                    | 150 mm                                                                                                           | 150 mm                                                                                               | Tubular covering entire range.                                                                                              |
| 4       | End connection               | ½ inch NPT (F)                                                                                                   | ¾ inch NPT (F)                                                                                       | Process connection as per ASME PTC and drain / vent 15 NB ±2%.                                                              |
| 5       | Accuracy                     | ±1% of span                                                                                                      | ±1% of span                                                                                          | ±2%                                                                                                                         |
| 6       | Scale                        | Linear, 270 Deg. Arc graduated in metri units.                                                                   | Linear, 270 Deg. Arc graduated in Deg. C                                                             | Linear vertical                                                                                                             |
| 7       | Range selection              | Cover 125% of max. of scale                                                                                      | Cover 125% of max. of scale                                                                          | Cover 125% of max. of scale                                                                                                 |
| 8       | Over range test              | Yes                                                                                                              | Yes                                                                                                  | Test pr. For the assembly shall be 1.5 to the max. design pr. at 38 Deg. C.                                                 |
| 9       | Housing                      | Weather and dust proof as per NEMA-4                                                                             | Weather and dust proof as per NEMA-4                                                                 | CS/304 SS leak proof                                                                                                        |
| 10      | Zero / Span adjustment       |                                                                                                                  | Provided                                                                                             | Provided                                                                                                                    |
| 11      | Identification               | Engraved with service legend or engraved phenolic laminated tag plate                                            | Engraved with service legend or laminated phenolic name plate                                        | Engraved with service legend or laminated phenolic name plate                                                               |
| 12      | Accessories                  | Blow out disc, siphon, snubber, pulsation dampener, chemical seal (if required by process) gauge isolation valve | SS Thermowell                                                                                        | Gasket for all KEL-F shield for transparent type vent and drain valves of Steel / SS as per CS / Alloy process requirement. |
| 13      | Material of Bourdon movement | 316 SS / 304 SS                                                                                                  | 316 SS / 304 SS                                                                                      | 316 SS / 304 SS                                                                                                             |



Technical specification  
for  
**2X660 MW STPP, MAITREE-BANGLADESH**

SECTION D

REV. NO.

00

DATE : 05.12.2017

**2. SPECIFICATION FOR ELECTRONIC TRANSMITTER FOR PRESSURE, D.P., ELECTRONIC TRANSMITTERS:**

| Sr. No. | Features                | Essential/Minimum Requirements                                                                                                                                                                                                                                                                                                                                        |
|---------|-------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1.      | Type of Transmitter     | Microprocessor based 2 wire type, Hart protocol compatible.                                                                                                                                                                                                                                                                                                           |
| 2.      | Accuracy                | $\pm 0.1\%$ of calibrated span (minimum)                                                                                                                                                                                                                                                                                                                              |
| 3.      | Output signal range     | 4-20 mA DC (Analog) along with superimposed digital signal based on HART protocol                                                                                                                                                                                                                                                                                     |
| 4.      | Turn down ratio         | 10:1 for vacuum/very low pressure applications.<br>30:1 for other applications.                                                                                                                                                                                                                                                                                       |
| 5.      | Stability               | $\pm 0.1\%$ of calibrated span for six months for Ranges up to and including 70 Kg/cm <sup>2</sup> .<br><br>$\pm 0.25\%$ of calibrated span for six months for Ranges more than 70 Kg/cm <sup>2</sup> (g).                                                                                                                                                            |
| 6.      | Zero and span drift     | +/- 0.015% per deg.C at max span.<br>+/-0.11% per deg.C at min. span.                                                                                                                                                                                                                                                                                                 |
| 7.      | Load impedance          | 500 ohm (min.)                                                                                                                                                                                                                                                                                                                                                        |
| 8.      | Housing                 | Weather proof as per IP-55 with durable corrosion resistant Coating.                                                                                                                                                                                                                                                                                                  |
| 9.      | Over Pressure           | 150% of max. Operating pressure                                                                                                                                                                                                                                                                                                                                       |
| 10.     | Connection (Electrical) | Plug and socket type                                                                                                                                                                                                                                                                                                                                                  |
| 11.     | Process connection      | 1/2 inch NPT (F)                                                                                                                                                                                                                                                                                                                                                      |
| 12.     | Span and Zero           | Continuous, tamper proof, Remote as well as adjustability Manual from instrument with zero suppression and elevation facility.                                                                                                                                                                                                                                        |
| 13.     | Accessories             | -Diaphragm seal, pulsation dampeners, siphon etc. as required by service and operating condition.<br><br>-2 valve manifold for absolute pressure transmitters (3-valve manifold for gauge/ vacuum pressure transmitters) and 5 valve manifold for DP/level/flow transmitters.<br><br>-For hazardous area, explosions proof enclosure as described in NEC article 500. |
| 14.     | Diagnostics             | Self Indicating feature                                                                                                                                                                                                                                                                                                                                               |
| 15.     | Power supply            | 24V DC $\pm 10\%$ .                                                                                                                                                                                                                                                                                                                                                   |
| 16.     | Adjustment/calibration/ | Centralized PC based system.                                                                                                                                                                                                                                                                                                                                          |



Technical specification  
for  
**2X660 MW STPP, MAITREE-BANGLADESH**

SECTION D

REV. NO.

00

DATE : 05.12.2017

Notes:

In case it becomes necessary to use a DP transmitter for pressure measurement then a 3-valve manifold should be used in place of 2-valve manifold.

LVDT type is not acceptable.

Where the process fluids are corrosive, viscous, solid bearing or slurry type, diaphragm seals shall be provided. Parts below the diaphragm shall be removable for cleaning. The entire volume above the diaphragm shall be completely filled with an inert liquid suitable for the application.

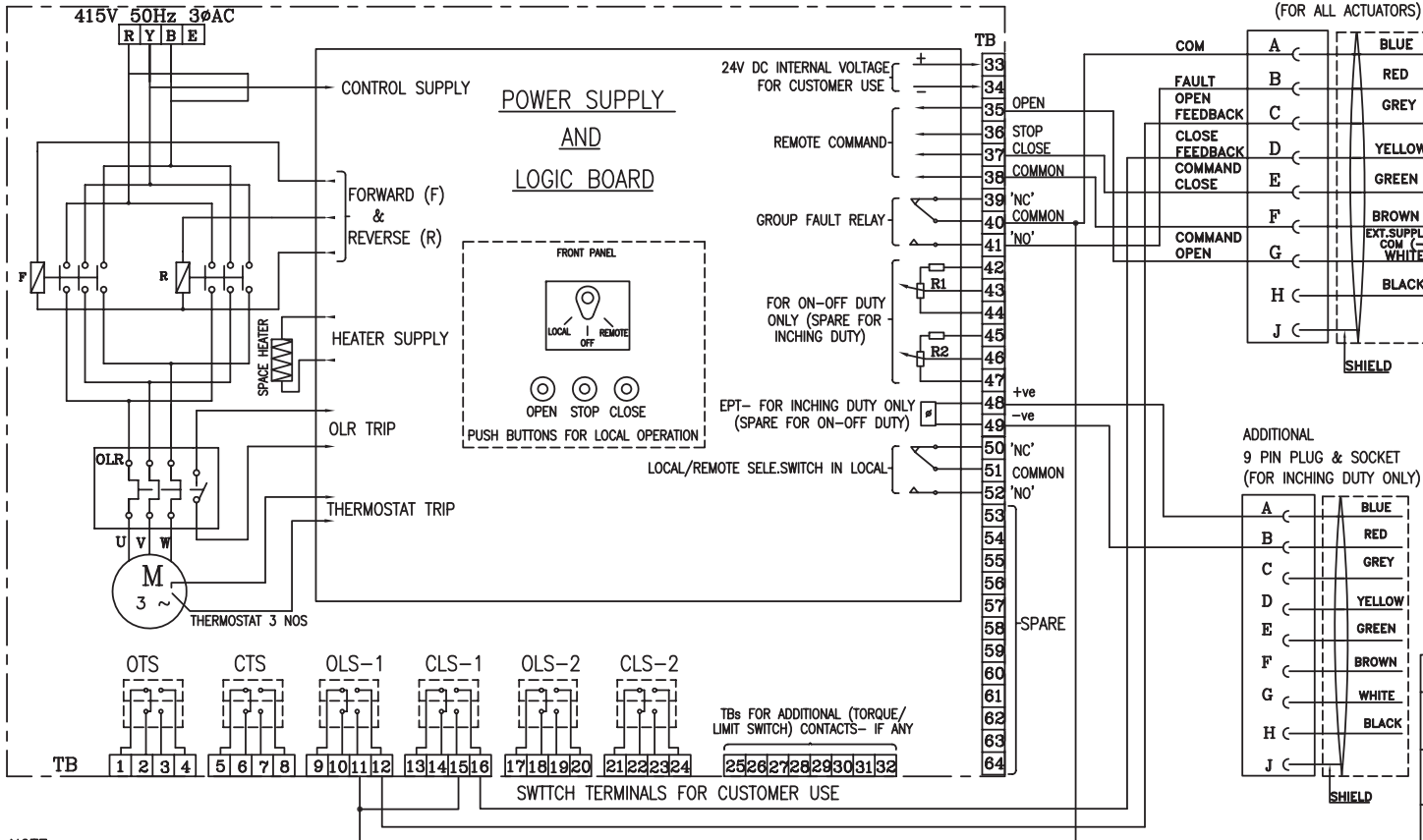
### 3. LIMIT SWITCH

For offsite plant application, Limit switches shall be gold plated with high conductivity and non-corrosive type. Contact rating shall be sufficient to meet the requirement of DDCMIS subject to a minimum of 60 V, 6 VA rating. Protection class shall be IP 55.

|                                             |                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                             |                                                                                           |
|---------------------------------------------|-----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------------------------------------------------------------------------------------|
|                                             | <b>SPECIFICATION<br/>FOR<br/>MOTORISED VALVE ACTUATOR</b> |                                                                                                                                                                                                                                                                                                                                                                                                                                      | SPECIFICATION NO.: PE-SS-421-145-I007       |                                                                                           |
|                                             |                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                      | VOLUME II B                                 |                                                                                           |
|                                             |                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                      | SECTION D                                   |                                                                                           |
|                                             |                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                      | REV. NO. 00                                 | DATE: 06.10.16                                                                            |
|                                             |                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                      | SHEET 1                                     | OF 3                                                                                      |
| <b>Data Sheet A &amp; B</b>                 |                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                             |                                                                                           |
| DATA SHEET-A<br>(TO BE FILLED BY PURCHASER) |                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                      | DATA SHEET-B<br>(TO BE FILLED-UP BY BIDDER) |                                                                                           |
| <b>GENERAL *</b>                            | * PROJECT                                                 | 2X660MA BIFPCL, MAITREE BANGLADESH                                                                                                                                                                                                                                                                                                                                                                                                   |                                             |                                                                                           |
|                                             | OFFER REFERENCE                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                             |                                                                                           |
|                                             | * TAG NO. SERVICE                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                             |                                                                                           |
|                                             | * DUTY                                                    | <input type="checkbox"/> ON / OFF <input type="checkbox"/> INCHING                                                                                                                                                                                                                                                                                                                                                                   |                                             |                                                                                           |
|                                             | * LINE SIZE (inlet/outlet): MATERIAL                      |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                             |                                                                                           |
|                                             | * VALVE TYPE                                              | <input type="checkbox"/> GLOBE <input type="checkbox"/> GATE <input type="checkbox"/> REG. GLOBE<br><input type="checkbox"/> BUTTERFLY                                                                                                                                                                                                                                                                                               |                                             |                                                                                           |
|                                             | * OPENING / CLOSING TIME                                  | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                             |                                             |                                                                                           |
|                                             | * WORKING PRESSURE                                        | <input type="checkbox"/>                                                                                                                                                                                                                                                                                                                                                                                                             |                                             |                                                                                           |
|                                             | AMBIENT CONDITION                                         | SHALL BE SUITABLE FOR CONTINUOUS OPERATION UNDER AN AMBIENT TEMP. OF 0-55 DEG C AND RELATIVE HUMIDITY OF 0-95%                                                                                                                                                                                                                                                                                                                       |                                             |                                                                                           |
|                                             | VALVE SEAT TEST PRESS                                     | BIDDER TO SPECIFY                                                                                                                                                                                                                                                                                                                                                                                                                    |                                             |                                                                                           |
|                                             | REQUIRED VALVE TORQUE                                     | BIDDER TO SPECIFY                                                                                                                                                                                                                                                                                                                                                                                                                    |                                             |                                                                                           |
|                                             | ACTUATOR RATED TORQUE                                     | BIDDER TO SPECIFY                                                                                                                                                                                                                                                                                                                                                                                                                    |                                             |                                                                                           |
| <b>CONSTRUCTION AND SIZING</b>              | CONSTRUCTION                                              | TOTALLY ENCLOSED, DUST TIGHT, WEATHER PROOF, SUITABLE FOR OUTDOOR USE WITHOUT CANOPY, IP:65                                                                                                                                                                                                                                                                                                                                          |                                             |                                                                                           |
|                                             | MECHANICAL POSITION INDICATOR                             | TO BE PROVIDED FOR 0-100% TRAVEL                                                                                                                                                                                                                                                                                                                                                                                                     |                                             |                                                                                           |
|                                             | BEARINGS                                                  | DOUBLE SHIELDED, GREASE LUBRICATED ANTI-FRICTION.                                                                                                                                                                                                                                                                                                                                                                                    |                                             |                                                                                           |
|                                             | GEAR TRAIN FOR LIMIT SWITCH/TORQUE SWITCH OPERATION       | METAL (NOT FIBRE GEARS). SELF-LOCKING TO PREVENT DRIFT UNDER TORQUE SWITCH SPRING PRESSURE WHEN MOTOR IS DE-ENERGIZED.                                                                                                                                                                                                                                                                                                               |                                             |                                                                                           |
|                                             | SIZING                                                    | OPEN/CLOSE AT RATED SPEED AGAINST DESIGNED DIFFERENTIAL PRESSURE AT 85% OF RATED VOLTAGE. FOR ISOLATING SERVICE THREE SUCCESSIVE OPEN-CLOSE OPERATIONS OR 15 MINS. WHICHEVER IS HIGHER. <b>FOR INCHING SERVICE - 150 STARTS/HR MINIMUM &amp; FOR REGULATING SERVICE - 600 STARTS/HR MINIMUM.</b>                                                                                                                                     |                                             |                                                                                           |
| <b>HANDWHEEL</b>                            | * REQUIRED                                                | <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO                                                                                                                                                                                                                                                                                                                                                                  |                                             |                                                                                           |
|                                             | * ORIENTATION                                             | <input type="checkbox"/> TOP MOUNTED <input type="checkbox"/> SIDE MOUNTED                                                                                                                                                                                                                                                                                                                                                           |                                             |                                                                                           |
|                                             | *TO DISENGAGE AUTOMATICALLY DURING MOTOR OPERATION.       |                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                             |                                                                                           |
| <b>ELECTRIC ACTUATOR</b>                    | ACTUATOR MAKE/MODEL                                       | BIDDER TO SPECIFY                                                                                                                                                                                                                                                                                                                                                                                                                    |                                             |                                                                                           |
|                                             | MOTOR MAKE / MODEL / TYPE / RATING (KW)                   | BIDDER TO SPECIFY                                                                                                                                                                                                                                                                                                                                                                                                                    |                                             |                                                                                           |
|                                             | @ MOTOR TYPE                                              | SQUIRREL CAGE INDUCTION MOTOR, STARTING CURRENT LIMITED TO SEVEN TIMES THE RATED CURRENT as per IEC-60034-30                                                                                                                                                                                                                                                                                                                         |                                             |                                                                                           |
|                                             | ACTUATOR APPLICABLE WIRING DIAGRAM                        | <input checked="" type="checkbox"/> ENCLOSED (BIDDER TO CONFIRM)<br>A: <input type="checkbox"/> DRG. NO. 3-V-MISC-24227 R00<br>B: <input type="checkbox"/> DRG. NO. 3-V-MISC-24550 R00<br>C: <input checked="" type="checkbox"/> DRG. NO. 3-V-MISC-24283 R00<br>D: <input type="checkbox"/> DRG. NO. 4-V-MISC-90271 R11<br>E: <input type="checkbox"/> For Thyristor based Integral starter, Bidder/Vendor to furnish wiring diagram |                                             |                                                                                           |
|                                             | COLOUR SHADE                                              | <input checked="" type="checkbox"/> BLUE (RAL 9003) <input type="checkbox"/> .....                                                                                                                                                                                                                                                                                                                                                   |                                             |                                                                                           |
|                                             | PAINT TYPE (## Refer Notes)                               | <input type="checkbox"/> ENAMEL <input checked="" type="checkbox"/> EPOXY <input type="checkbox"/> .....                                                                                                                                                                                                                                                                                                                             |                                             |                                                                                           |
|                                             | SHAFT RPM                                                 | BIDDER TO SPECIFY                                                                                                                                                                                                                                                                                                                                                                                                                    |                                             |                                                                                           |
|                                             | OLR SET VALUE                                             | BIDDER TO SPECIFY                                                                                                                                                                                                                                                                                                                                                                                                                    |                                             |                                                                                           |
|                                             | @ STARTING / FULL LOAD CURRENT                            | BIDDER TO SPECIFY                                                                                                                                                                                                                                                                                                                                                                                                                    |                                             | Starting current shall not exceed 7 times rated current as per IEC 60034 for IE-3 motors. |
|                                             | NO. OF REV FOR FULL TRAVEL                                | BIDDER TO SPECIFY                                                                                                                                                                                                                                                                                                                                                                                                                    |                                             |                                                                                           |

|                                                                                   |                                                                                                     |                                                                                                                                                        |                                       |                                                                             |                                             |                                                                           |
|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|-----------------------------------------------------------------------------|---------------------------------------------|---------------------------------------------------------------------------|
|  | <b>SPECIFICATION<br/>FOR<br/>MOTORISED VALVE ACTUATOR</b>                                           |                                                                                                                                                        | SPECIFICATION NO.: PE-SS-421-145-I007 |                                                                             |                                             |                                                                           |
|                                                                                   |                                                                                                     |                                                                                                                                                        | VOLUME II B                           |                                                                             |                                             |                                                                           |
|                                                                                   |                                                                                                     |                                                                                                                                                        | SECTION D                             |                                                                             |                                             |                                                                           |
|                                                                                   |                                                                                                     |                                                                                                                                                        | REV. NO.                              | 00                                                                          | DATE: 06.10.16                              |                                                                           |
|                                                                                   |                                                                                                     |                                                                                                                                                        | SHEET                                 | 2                                                                           | OF                                          | 3                                                                         |
| <b>Data Sheet A &amp; B</b>                                                       |                                                                                                     |                                                                                                                                                        |                                       |                                                                             |                                             |                                                                           |
| DATA SHEET-A<br>(TO BE FILLED BY PURCHASER)                                       |                                                                                                     |                                                                                                                                                        |                                       |                                                                             | DATA SHEET-B<br>(TO BE FILLED-UP BY BIDDER) |                                                                           |
|                                                                                   | @ PWR SUPP TO MTR / STARTER                                                                         | 415V, 3PH, AC                                                                                                                                          |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | @ CONTROL VOLTAGE REQUIREMENT                                                                       | TO BE DERIVED FROM THE POWER SUPPLY TO THE STARTER <input type="checkbox"/> 230 V <input type="checkbox"/> 110 V                                       |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | @ ENCLOSURE CLASS OF MOTOR                                                                          | <input type="checkbox"/> IP 67 <input type="checkbox"/> FLAME PROOF                                                                                    |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | @ INSULATION CLASS                                                                                  | CLASS-F TEMP. RISE LIMITED TO CLASS-B                                                                                                                  |                                       |                                                                             |                                             | As per IEC-60034                                                          |
|                                                                                   | @ WINDING TEMP PROTECTION                                                                           | <input checked="" type="checkbox"/> THERMOSTAT (3 Nos., 1 IN EACH PHASE)<br><input type="checkbox"/> .....                                             |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | SINGLE PHASE / WRONG PHASE SEQUENCE PROTECTION                                                      | REQUIRED                                                                                                                                               |                                       |                                                                             |                                             |                                                                           |
| <b>INTEGRAL STARTER</b>                                                           | INTEGRAL STARTER                                                                                    | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED                                                                     |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | TYPE OF SWITCHING DEVICE                                                                            | <input checked="" type="checkbox"/> CONTACTORS <input type="checkbox"/> THYRISTORS                                                                     |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | TYPE                                                                                                | <input checked="" type="checkbox"/> CONVENTIONAL <input type="checkbox"/> SMART (NON-INTRUSIVE)                                                        |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | IF SMART                                                                                            |                                                                                                                                                        |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | a) SERIAL LINK INTERFACE                                                                            | <input type="checkbox"/> INTEGRAL <input type="checkbox"/> FIELD MOUNTED                                                                               |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | b) SERIAL LINK PROTOCOL                                                                             | <input type="checkbox"/> FOUNDATION FIELD-BUS <input type="checkbox"/> PROFI-BUS<br><input type="checkbox"/> DEVICE NET <input type="checkbox"/> ..... |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | c) SERIAL LINK MEDIA                                                                                | <input type="checkbox"/> TWISTED PAIR Cu-CBL <input type="checkbox"/> CO-AXIAL Cu-CBL<br><input type="checkbox"/> OFC                                  |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | d) HAND HELD PROGRAMMER                                                                             | <input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED                                                                                |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | e) TYPE OF HAND HELD PROGRAMMER                                                                     | <input type="checkbox"/> BLUETOOTH <input type="checkbox"/> INFRARED <input type="checkbox"/> .....                                                    |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | f) MASTER STATION                                                                                   | <input type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED                                                                                |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | g) MASTER STN INTRFACE WITH DCS                                                                     | <input type="checkbox"/> MODBUS <input type="checkbox"/> TCP/IP                                                                                        |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | h) DETAILS OF SPECIAL CABLE                                                                         | <input type="checkbox"/> ENCLOSED <input type="checkbox"/> NOT REQUIRED                                                                                |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | STEP DOWN CONT. TRANSFORMER                                                                         | <input checked="" type="checkbox"/> REQUIRED                                                                                                           |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | OPEN / CLOSE PB                                                                                     | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED                                                                     |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | STOP PB                                                                                             | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED                                                                     |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | INDICATING LAMPS                                                                                    | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED                                                                     |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | LOCAL REMOTE S/S                                                                                    | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED                                                                     |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | STATUS CONTACTS FOR MONITORING                                                                      | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED                                                                     |                                       |                                                                             |                                             |                                                                           |
| INTEGRAL STARTER DISTURBED SIGNAL                                                 | REQUIRED (O/L RELAY OPERATED, CONT./POWER SUPPLY FAILED, S/S IN LOCAL, TORQUE SWITCH OPTD. MID WAY) |                                                                                                                                                        |                                       |                                                                             |                                             |                                                                           |
| <b>INTERPOSING RELAY/OPTO COUPLER</b><br>(Applicable for integral Starter)        | TYPE OF ISOLATING DEVICE                                                                            | <input checked="" type="checkbox"/> INTERPOSING RELAY <input type="checkbox"/> OPTO COUPLER<br><input type="checkbox"/> EITHER                         |                                       |                                                                             |                                             | The coils of interposing relays shall be connected to freewheeling diode. |
|                                                                                   | QUANTITY                                                                                            | <input checked="" type="checkbox"/> 2 Nos. <input type="checkbox"/> 3 Nos.                                                                             |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | DRIVING VOLTAGE                                                                                     | <input checked="" type="checkbox"/> 20.5 – 24V DC <input type="checkbox"/> _____ V DC                                                                  |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | DRIVING CURRENT                                                                                     | <input checked="" type="checkbox"/> 125mA MAX <input type="checkbox"/> _____ mA MAX                                                                    |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | LOAD RESISTANCE                                                                                     | <input checked="" type="checkbox"/> > 192 ohms - <25 k ohms<br><input type="checkbox"/> > _____ ohms - < _____ ohms                                    |                                       |                                                                             |                                             |                                                                           |
| <b>TORQUE SWITCH</b><br>(Not Applicable for Smart Actuator)<br>(\$\$ Refer Notes) | MFR & MODEL NO.                                                                                     | BIDDER TO SPECIFY                                                                                                                                      |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | OPEN / CLOSE                                                                                        | <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos. / <input checked="" type="checkbox"/> 1 No. <input type="checkbox"/> 2Nos     |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | CONTACT TYPE                                                                                        | 2 NO + 2 NC                                                                                                                                            |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | RATING                                                                                              | 5A 240V AC AND 0.5A 220V DC                                                                                                                            |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | CALIBRATED KNOBS(OPEN&CLOSE TS)                                                                     | REQUIRED FOR SETTING DESIRED TORQUE                                                                                                                    |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | ACCURACY                                                                                            | +3% OF SET VALUE                                                                                                                                       |                                       |                                                                             |                                             |                                                                           |
| <b>LIMIT SWITCH</b><br>(Not Applicable)                                           | MFR & MODEL NO.                                                                                     | BIDDER TO SPECIFY                                                                                                                                      |                                       |                                                                             |                                             |                                                                           |
|                                                                                   | OPEN : INT : CLOSE                                                                                  | <input checked="" type="checkbox"/> 1 No<br><input type="checkbox"/> 2 Nos.                                                                            | 2 Nos. (ADJ.)                         | <input checked="" type="checkbox"/> 1 No.<br><input type="checkbox"/> 2Nos. |                                             |                                                                           |

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                          |                                                                                                                                                                 |                                             |                |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|----------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <b>SPECIFICATION<br/>FOR<br/>MOTORISED VALVE ACTUATOR</b>                |                                                                                                                                                                 | SPECIFICATION NO.: PE-SS-421-145-I007       |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                          |                                                                                                                                                                 | VOLUME II B                                 |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                          |                                                                                                                                                                 | SECTION D                                   |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                          |                                                                                                                                                                 | REV. NO. 00                                 | DATE: 06.10.16 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                          |                                                                                                                                                                 | SHEET 3                                     | OF 3           |
| <b>Data Sheet A &amp; B</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                          |                                                                                                                                                                 |                                             |                |
| DATA SHEET-A<br>(TO BE FILLED BY PURCHASER)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                          |                                                                                                                                                                 | DATA SHEET-B<br>(TO BE FILLED-UP BY BIDDER) |                |
| for Smart<br>Actuator) (\$\$<br>Refer Notes)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | CONTACT TYPE                                                             | 2 NO + 2 NC                                                                                                                                                     |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | RATING (AC / DC)                                                         | 5A 240V AC AND 0.5A 220V DC                                                                                                                                     |                                             |                |
| <b>POSITION<br/>TRANSMITTER</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | POSITION TRANSMITTER (For inching<br>duty & other specific applications) | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED                                                                              |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | MFR & MODEL NO.                                                          | BIDDER TO SPECIFY                                                                                                                                               |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | TYPE                                                                     | <input type="checkbox"/> ELECTRONIC (2 WIRE) R/I CONVERTER<br><input checked="" type="checkbox"/> ELECTRONIC (2 WIRE) CONTACTLESS                               |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | SUPPLY                                                                   | <input checked="" type="checkbox"/> 24V DC <input type="checkbox"/> .....                                                                                       |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | OUTPUT                                                                   | <input checked="" type="checkbox"/> 4-20mA                                                                                                                      |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ACCURACY                                                                 | $\pm 1\%$ FS                                                                                                                                                    |                                             |                |
| <b>SPACE<br/>HEATER</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | @SPACE HEATER                                                            | REQUIRED                                                                                                                                                        |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | @ POWER SUPPLY (NON INTEGRAL)                                            | 230V AC, 1 PH., 50 Hz                                                                                                                                           |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | @ POWER SUPPLY (INTEGRAL)                                                | BIDDER TO SPECIFY                                                                                                                                               |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | @ RATING                                                                 |                                                                                                                                                                 |                                             |                |
| <b>TERMINAL<br/>BOX</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ACTUATOR/MOTOR TERMINAL BOX                                              | REQUIRED                                                                                                                                                        |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ENCL CLASS ACTUATOR/MOTOR T.B.                                           | @ <input type="checkbox"/> IP 68 @ <input type="checkbox"/> .....                                                                                               |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | @ EARTHING TERMINAL                                                      | REQUIRED                                                                                                                                                        |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | PLUG & SOCKET (9 PIN)<br>(FOR COMMD, LS/TS FEED BACK, PoT)               | <input checked="" type="checkbox"/> REQUIRED <input type="checkbox"/> NOT REQUIRED<br><input checked="" type="checkbox"/> 2 NOS. <input type="checkbox"/> ..... |                                             |                |
| <b>CABLE GLANDS</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | @ POWER CABLE GLAND                                                      | SIZE:-----                                                                                                                                                      |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | @ SPACE HEATER CABLE GLAND                                               | SIZE:-----                                                                                                                                                      |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | OTHER CONTROL CABLE GLANDS-1                                             | <input type="checkbox"/> 1No. for BFV of CW PUMP (Cable size 2Px1.5mm2)                                                                                         |                                             |                |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | OTHER CONTROL CABLE GLANDS-2                                             | QUANTITY & SIZE :-----                                                                                                                                          |                                             |                |
| <b>WEIGHT</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | TOTAL WEIGHT (ACTUATOR +<br>ACCESSORIES)                                 | BIDDER TO SPECIFY                                                                                                                                               |                                             | _____ Kg.      |
| <b>NOTES:</b><br>1. <b>SCOPE:</b> DESIGN, MANUFACTURE, INSPECTION, TESTING AND DELIVERY TO SITE OF ELECTRIC ACTUATOR FOR INCHING OR OPEN / CLOSE DUTY.<br>2. <b>CODES &amp; STANDARDS:</b> DESIGN AND MATERIALS USED SHALL COMPLY WITH THE RELEVANT LATEST INTERNATIONAL STANDARD (INDIAN CODES ARE NOT ACCEPTABLE).<br>3. TEMPERATURE RISE SHALL BE RESTRICTED TO 70 DEG. C FOR AMBIENT TEMPERATURE OF 50 DEG C.<br>4. CABLE GLANDS OF DOUBLE COMPRESSION TYPE, BRASS MATERIAL SHALL BE PROVIDED.<br>5. THE TORQUE SWITCHES SHALL BE PROVIDED WITH MECHANICAL LATCHING DEVICE TO PREVENT OPERATION WHEN UNSEATING FROM THE END POSITIONS. THE LATCHING DEVICE SHALL UNLATCH AS SOON AS THE VALVE LEAVES THE END POSITION. IF SUCH PROVISION IS NOT POSSIBLE, THE TORQUE SWITCHES SHALL BE BYPASSED BY END-POSITION LIMIT SWITCHES WHICH OPENS ON VALVE LEAVING END POSITION. THESE LIMIT SWITCHES ARE ADDITIONAL TO THE NUMBER OF LIMIT SWITCHES SPECIFIED ELSEWHERE.<br>6. THE MOTOR SHALL OPERATE SATISFACTORILY UNDER THE +/- 10% SUPPLY VOLTAGE VARIATION AT RATED FREQUENCY, <b>-6% TO +4%</b> VARIATION IN FREQUENCY AT RATED SUPPLY VOLTAGE, SIMULTANEOUS VARIATION IN VOLTAGE & FREQUENCY THE SUM OF ABSOLUTE PERCENTAGE NOT EXCEEDING 10%.<br>7. THE MOTOR SHALL BE SUITABLE FOR DIRECT ON LINE STARTING.<br><b>\$\$ TORQUE SWITCH &amp; LIMIT SWITCH SHALL ACT INDEPENDENT OF EACH OTHER. TANDEM OPERATION IS NOT ACCEPTABLE.</b><br><b>## EPOXY PAINT IS RECOMMENDED FOR COASTAL AREAS.</b> |                                                                          |                                                                                                                                                                 |                                             |                |
| NOTES* = TO BE FILLED BY MPL (LEAD AGENCY). @ = TO BE FILLED BY ES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                          |                                                                                                                                                                 |                                             |                |

3-V-MISC-24283  
DRAWING NO.

| CONTACT DEVELOPMENT DIAGRAM                     |              |                                            |   |              |
|-------------------------------------------------|--------------|--------------------------------------------|---|--------------|
| OTS                                             | 1-2          | OPEN AT OVER TORQUE DURING OPENING TRAVEL  |   |              |
|                                                 | 3-4          | CLOSE AT OVER TORQUE DURING OPENING TRAVEL |   |              |
| CTS                                             | 5-6          | OPEN AT OVER TORQUE DURING CLOSING TRAVEL  |   |              |
|                                                 | 7-8          | CLOSE AT OVER TORQUE DURING CLOSING TRAVEL |   |              |
| OLS-1                                           | 9-10         | ●                                          |   |              |
|                                                 | 11-12        | ●                                          |   |              |
| CLS-1                                           | 13-14        |                                            |   | ●            |
|                                                 | 15-16        |                                            |   | ●            |
| OLS-2                                           | 17-18        | ●                                          |   |              |
|                                                 | 19-20        | ●                                          |   |              |
| CLS-2                                           | 21-22        |                                            |   | ●            |
|                                                 | 23-24        |                                            |   | ●            |
| SWITCH                                          | TERMINAL NO. | FULL OPEN                                  | a | INTERMEDIATE |
|                                                 |              |                                            | b | FULL CLOSE   |
| VALVE POSITION                                  |              |                                            |   |              |
| —————                                           |              | INDICATES CONTACT CLOSED                   |   |              |
| -----                                           |              | INDICATES CONTACT OPEN                     |   |              |
| CONTACT RATING: 5A AT 250V AC & 0.5A AT 220V DC |              |                                            |   |              |

| SETTING PROCEDURE OF POSITION LIMIT AND TORQUE SWITCH          |      |         |       |
|----------------------------------------------------------------|------|---------|-------|
| VALVES                                                         | OPEN |         | CLOSE |
|                                                                | MAIN | BACK UP | MAIN  |
| GATE VALVE OF 100 mm AND ABOVE IN 1500 CL AND ABOVE RATINGS    | OLS  | OTS *   | CLS   |
| ALL OTHER GATE & GLOBE VALVES                                  | OLS  | OTS *   | CTS   |
| # - CLS NOT TO BE CONNECTED IN TRIP CIRCUIT                    |      |         |       |
| * - BYPASS OTS FOR INITIAL 5% OF TRAVEL (FOR GATE VALVES ONLY) |      |         |       |

NOTE:-

- ALL TORQUE AND LIMIT SWITCHES (OTS, CTS, OLS1&2, CLS1&2) ARE WITH 2NO+2NC CONTACTS '1NO+1NC' IS TERMINATED IN TBS 1-24, REMAINING CONTACTS ARE FOR INTERNAL USE.
- ANY SPARE CONTACTS WHICH ARE NOT USED INTERNALLY ARE TO BE TERMINATED IN TBS 25-32
- CTS - TORQUE SWITCHES FOR CW ROTATION (CLOSE)
- OTS - TORQUE SWITCHES FOR CCW ROTATION (OPEN)
- OLS-1, OLS-2 - LIMITSWITCHES FOR POSITION OPEN
- CLS-1, CLS-2 - LIMITSWITCHES FOR POSITION CLOSE
- EPT - ELECTRONIC POSITION TRANSMITTER (CONTACTLESS TYPE, FOR INCHING DUTY)
- R1-R2-POTENTIOMETER 2 x 100 OHMS (FOR ON-OFF DUTY)
- FOR COMMANDS & EPT EITHER INTERNALLY GENERATED 24 VDC OR EXTERNAL SUPPLY OF 24VDC CAN BE USED
- M - MOTOR 3 $\phi$  415V 50 Hz AC SUPPLY
- TORQUE SWITCH BYPASS WITH LIMITSWITCH BOTH ON OPEN & CLOSE DIRECTION TO BE DONE INTERNALLY.

| REV | DATE | ALTERED    |
|-----|------|------------|
|     |      | CHD & APPD |

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

|                                                                                                                                                                                                                         |    |                                                                                       |                                                                                                       |                      |                                          |                  |                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|---------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|----------------------|------------------------------------------|------------------|-----------------|
| TYPE OF PRODUCT<br>OR NAME OF<br>CUSTOMER/PROJECT                                                                                                                                                                       |    |                                                                                       | ELECTRICAL VALVE ACTUATORS (AC) WITH INTEGRAL STARTERS<br>(DRAWN FOR INTERMEDIATE POSITION OF VALVES) |                      |                                          |                  |                 |
| <div><br/>365-121</div> <div>BHARAT HEAVY ELECTRICALS LTD.,<br/>UNIT: HIGH PRESSURE BOILER PLANT.<br/>TIRUCHIRAPALLI-620014.</div> |    |                                                                                       | DRN                                                                                                   | NAME<br>N.P.ESWAR    | SIGN<br>N.P                              | DATE<br>17.03.05 | NO.OF<br>VAR.   |
|                                                                                                                                                                                                                         |    |                                                                                       | CHD                                                                                                   | D.DINAKARAN          | D.D                                      | 17.03.05         | -               |
|                                                                                                                                                                                                                         |    |                                                                                       | APPD                                                                                                  | K.ARUNACHALAM        | K.A                                      | 17.03.05         | -               |
| DEPT                                                                                                                                                                                                                    | VL |  | SCALE                                                                                                 | WEIGHT (KG).         | REFERENCE INFORMATION                    |                  | NO. OF<br>ITEMS |
| CODE                                                                                                                                                                                                                    | -  |                                                                                       | NTS                                                                                                   | -                    |                                          |                  | -               |
| TITLE<br>WIRING DIAGRAM (TERMINAL PLAN)<br>FOR ACTUATOR WITH INTEGRAL STARTER WITH PLUG & SOCKET                                                                                                                        |    |                                                                                       |                                                                                                       | CARD<br>CODE<br>U 01 | DRAWING NO.<br>3-V-MISC-24283<br>Page 21 |                  | REV<br>0        |

Size A3



Technical specification  
for  
**2X660 MW MAITREE STPP, BANGLADESH**

SECTION: D

REV. NO. 00 DATE : 05.12.2017

# **LCP SPECIFICATION & DATASHEET**



## SPECIFICATION FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS -999- 145 -054A

VOLUME II B

SECTION D

REV. NO. 03

DATE : 20-11-2017

SHEET 1 OF 5

### 1.0 SCOPE

This specification covers the Design, Manufacture, Inspection and Testing at the manufacturer's works, proper packing for transportation and delivery to site, supervision, erection, and commissioning at site of Local Panels required for control and monitoring of the Auxiliary Plant & Equipment.

### 2.0 CODES AND STANDARDS

2.1 All the equipments specified herein shall comply with the requirements of the latest issue of the relevant International standards as mentioned in codes and standard section of this specification.

### 3.0 TECHNICAL REQUIREMENTS

#### 3.1 Panel Construction

- 3.1.1 The local panels shall house the secondary instruments, annunciation system, Single loop controller, Control switches / push buttons, indicating lamps/LED cluster, relays, timers and other devices required for operation and monitoring of the equipment locally.
- 3.1.2 The panels shall be of free standing type either welded construction on angle iron (minimum section of 50 x 50 x 4 mm) structure or folded construction by sheet metal formation depending upon the equipments to be mounted on it. The panels shall be robustly built and stiffeners as necessary shall be provided.
- 3.1.3 The panel shall be suitably reinforced to ensure adequate support for all instruments mounted thereon. All welds on exposed panel surfaces shall be ground smooth.
- 3.1.4 The salient features of construction shall be:
- Sheet material: Cold rolled sheet steel
  - Frame thickness: Not less than 3.0mm
  - Enclosure thickness: Not less than 2.5 mm for load bearing sections (Mounted with instruments)  
1.6 mm for doors and Not less than 2.0 mm for others
  - Panel Height: Not less than 2365 mm (Refer data sheet-A (No. PES-145A-DS1-0)
  - Gland plate thickness: 3.0mm
  - Base channel: ISMC 100 with anti-vibration mounting & foundation bolts.
- 3.1.5 The panel shall be provided with rear doors with integral lockable handle. The door when locked shall be held at minimum three places. The door width shall not be more than 550mm. The doors shall be provided with suitable stiffeners to prevent buckling. The handle shall be on the right side of the door. The door shall be removable type with concealed hinges to facilitate maintenance work. Suitable pocket inside the door shall be provided for keeping the drawings / documents. Double door shall be provided with suitable glass windows, as per the requirement.
- 3.1.6 Suitable neoprene gasket shall be provided on all doors and removable covers. Suitable ventilation system along with louvers shall be provided at bottom and top of the doors covered with removable wire mesh.
- 3.1.7 The class of protection shall be in accordance with Cl. No. B0.6.18.4 – "Installation conditions and protection class for electrical operational equipment and control and monitoring equipment" under section IA-Customer's general technical specification – B0. Also refer Cl. No. B0.6.18.15 for Local control points.
- 3.1.8 All steel surfaces shall be cleaned by sand / pellet blasting, treated for pickling, degreasing and phosphating etc. by seven tank method. The panel shall have a high quality finish and appearance. The panel shall be painted with two coats of primer followed by two coats of epoxy / synthetic enamel based final paint of color shade and finish as given in data sheet-A (No. PES-145A-DS1-0). Minimum thickness of the paint shall be 85 microns for external paint and 70 microns for internal paint.



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- 3.1.9 The cable glands of the required size and type as given in data sheet-A (No. PES-145A-DS1-0) shall be supplied along with the Panel.
- 3.1.10 All operable and indicating devices shall be mounted on the front of the panel while aux. Relays / timers MCBs etc. required for realization of control logics shall be mounted on a mounting plate inside the panel. Auxiliary relays and timers etc. shall be grouped according to the control function. No operable or indicating devices shall be mounted below 750 mm and above 1800 mm (w.r.t. finished ground level). The devices shall be located in such a way so as to ensure easy access for operation / maintenance.
- 3.1.11 Single / dual control power supply feeders of voltage class as specified in data sheet-A (No. PES-145A-DS1-0) shall be provided by the purchaser. In case redundant power supply feeders are provided then auto changeover unit shall be mounted on the panel are in the panel supplier's scope. Where DC control power supply is specified an additional 240V, 50 Hz AC supply feeder for powering of space heater and lighting shall be provided by the purchaser. Suitable arrangement shall be provided inside the panel to receive and terminate the power supply feeder(s). For this purpose, MCBs of suitable current rating shall be provided by the vendor. A supervisory relay along with a pilot lamp to indicate control supply 'ON' shall be provided on the panel. Any other power supply required for the operation of the devices mounted in the panel shall be arranged by the vendor.
- 3.1.12 The internal wiring shall be carried out with 1100 volt grade PVC insulated copper multi strand wire / flexible of 1.5mm<sup>2</sup> size. AC & DC wires shall be kept separate from each other. Separate colored wires to be used for AC and DC circuits. All wires shall be properly numbered and identified with ferrules as per the Control scheme / wiring diagram. Wires shall be routed and run through PVC troughs.
- 3.1.13 Terminal blocks shall be clip on type, 1100 volts grade. Separate terminal blocks shall be used for AC & DC circuits. The terminals shall be suitable for terminating 0.5 mm<sup>2</sup> to 2.5mm<sup>2</sup> external cables. The TB points in terminal block shall be cage clamp type / screw type. The terminal for ammeters shall be provided with removable links for shorting CTs. Each terminal strip shall be provided with identification strip. The terminal shall not be mounted below 250 mm height from finished floor. The panel shall have ten (20) percent spare terminal.
- 3.1.14 The interior of each panel shall be suitably illuminated through fluorescent lamps / tube lights with shrouded cover of minimum 15W operable on 240V 50 Hz AC power supply through panel door switch. A 15 Amp. 3-pin Power receptacle shall be provided.
- 3.1.15 Suitable space heaters operable on 240 Volts 50 Hz AC power system shall be provided at the panel bottom. These shall be designed to maintain the panel temperature five (5) deg. C above the ambient temperature during maintenance shutdown. Suitable isolating and control devices comprising of MCB, thermostat etc. shall be provided for the space heater.
- 3.1.16 The panel shall be provided with a copper earth bus of 25 x 6 mm size running throughout the width of the panel. It shall be terminated internally with 10 mm bolts at extreme ends for connection to; main station earth. The panel mounted equipments / devices shall be connected to earth bus through green colored PVC insulated stranded copper conductor of 2.5 mm<sup>2</sup> size.
- 3.1.17 Local Panel shall be provided with main name plate of 150 mm x 40 mm size having inscription of 20 mm height. The individual devices on the panels shall be as provided with separate name plate with inscription of 3 mm height. The instrument / devices shall be provided with stick on label plates inside the panel. The material of the main and individual labels shall be three (3) ply 3 mm thick Traffolyte Sheet / 2 mm Anodised Aluminium Plate. The inscription shall be with white letters on black background on traffolyte sheet. The labels shall be fixed by self tapping non-rusting screws.
- 3.1.18 Vendor shall furnish electric load and heat load list ( in case panel is to be placed in an ac environment ) of each panel.



## SPECIFICATION FOR LOCAL PANELS

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### 3.2 Hazardous Area Panel Requirement

3.2.1 The Local Panel located in hazardous area shall be pressurized as per NFPA-496 requirements to render it non-hazardous. Alarms shall be provided for local and remote annunciation when pressurisation falls below 2.5 mm of water column. Protection shall be of type Z of NFPA-496. It shall not be possible to switch ON the power of purged section unless it is purged as per the recommendation of NFPA-496. Vendor must provide a protective device on the panel to protect the panel from over pressurisation.

3.2.2 Vendor shall supply pressurisation kit consisting of valves, restriction orifices, dual filter regulation, pressure gauges, pressure switches, rotameter etc. Pressurisation kit shall be surface mounting on a metal board and located outside the local panel. Pressurisation kit shall further consist of solenoid valve flow switch, timer blow off safety device etc., so as to make purging fully automatic. However final start shall be manual. Panel protection against over pressure to be provided as per NFPA-496.

3.2.3 Pressurised local control panel pressurization kit assembly design shall provide minimum leakage flow through the Local Control Panel. Panel venting shall be as per NFPA-496.

3.2.4 All components in the local panel like indicating instruments, push buttons switches, lamps etc., which are required to be energized without panel pressurization or before completion of purge cycle shall be explosion proof as per NEMA-7 & suitable for area classification.

3.2.5 All push buttons etc. requiring frequent operation during machine running shall have good positive sealing. Weatherproof housing or cover to be provided wherever necessary. Vendor shall provide pressurisation bypass switch outside explosion proof enclosure of pressurized panel with lamp indication. This shall be used only during maintenance. All hinges, screws, other non-painted metallic parts shall be of stainless steel material.

3.2.6 Provision to switch off manually all types of power shall be provided in the panel. In addition, it shall also be possible to switch off power circuits / components which are powered from motor control centre or control room manually in case of pressurization failure. All such cables from MCC and main control room shall be terminated in explosion proof boxes (NEMA-7).

### 3.3 Control & Monitoring devices

3.3.1 Instruments like Indicators, recorders, single loop controllers etc. as applicable and specified elsewhere for the plant / equipment shall be supplied and mounted on the panel.

#### 3.3.2 Alarm Annunciator System

It shall be solid state discrete facia type having a sequence of ISA-S18.1A or as specified, opaque facia windows of 70 mm x 50 mm size, having two (2) lamps per window, and hooter of 10W, and provision for repeat group alarm at remote. The annunciator shall be provided with ten (10) percent spare windows or minimum two (2) windows along with electronics.

#### 3.3.3 Relays

The relays shall be electromagnetic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable. There shall be ten (10) percent spare contacts.

#### 3.3.4 Timers

The timers shall be electronic type suitable for specified control supply. Its contact configuration and rating shall be suitable for the specified control function. However, minimum contact rating shall be 5 Amp AC & 2 Amp DC as applicable.

#### 3.3.5 Control / Selector Switches

Switches shall be Rotary Cam type with minimum of 5 Amps AC & 2 Amp DC continuous current rating. Selector switches shall be stay put type while control switches shall be spring-return-to-neutral type. Contact configuration and rating shall be as per the control function requirement. The switches shall be lockable type wherever specified. Each switch shall be provided with engraved plates indicating the switch position / functions.



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### 3.3.6 Push Buttons / Indicating Lights

The push buttons shall be momentary action self-resetting type, however stop P.B. for unidirectional drives shall be provided with manual reset facility. Its contact configuration & rating shall be as required for the control function but minimum 2 NO + 2 NC of 5 Amp. AC rating. It shall have round coloured projecting tab and engraved escutcheon plate / inscription plate. Colour coding of push buttons shall be as under:

|       |                         |        |                   |                 |
|-------|-------------------------|--------|-------------------|-----------------|
| RED   | Motor OFF / Valve CLOSE | YELLOW | Alarm acknowledge | Left Hand Side  |
| GREEN | Motor ON / Valve OPEN   | BLACK  | Lamp test         | Right Hand Side |

Indicating lights shall be suitable for direct connections across specified power supplies. It shall be fitted with built in resistance to prevent circuit tripping on shorting of lamp filament. It shall be fitted with LED cluster type lamp replaceable from front.

|       |                                    |       |                  |                 |
|-------|------------------------------------|-------|------------------|-----------------|
| GREEN | Motor OFF / Valve CLOSED condition | AMBER | Motor tripped    | Left Hand Side  |
| RED   | Motor ON / Valve OPEN condition    | WHITE | Normal / healthy | Right Hand Side |

Ammeter shall be 96 x 96 mm size, 90 deg. deflection, 1.5% accuracy, 1 Amp. CT operated or with 4-20mA input and Flush mounting type as called for in the data sheet-A (No. PES-145-54A-DS1-0). Ammeters for motors shall have six (6) times folded scale at upper end to enable motor starting current indication

### 3.3.8 Miniature Circuit Breaker (MCB)

These shall be instantaneous magnetic trip type for short circuit in addition to current time inverse delayed thermal trip feature for over current protection. The housing of MCB shall be made of non-ignitable, high impact material. It shall have minimum short circuit rating of 9 KA for AC Voltages and 4 KA for DC Voltages.

### 3.3.9 Makes of various instruments / devices shall be as given below

|    |                                 |   |                                        |
|----|---------------------------------|---|----------------------------------------|
| 1. | Alarm Annunciators              | : | Procon / IIC                           |
| 2. | Ammeters                        | : | AEP / IMP                              |
| 3. | Control / Selector Switches     | : | Alsthom / Kaycee / Siemens / L&T       |
| 4. | Push Buttons / Indicating Lamps | : | Siemens / L&T / Teknic / Alsthom       |
| 5. | Auxiliary Relays                | : | Jyoti / Siemens / L&T / OEN            |
| 6. | Timers                          | : | L&T / Alsthom / Bhartiya Cutler Hammer |
| 7. | MCBs                            | : | S&S Power Engg. / Indo Asian / MDS     |
| 8. | Terminal Blocks                 | : | Jyoti / Elmex                          |

## 4.0 TESTING AND INSPECTION

4.1 The bidder shall adopt suitable quality assurance program to ensure that the equipments offered will meet the specification requirements in full.

4.2 BHEL's standard Quality Plan for LCP is enclosed with the specification. The bidder shall furnish his acceptance to BHEL's QP and submit the signed and stamped copy of QP along with the offer.

4.3 The vendor shall conduct the following tests as a minimum requirement:

#### 4.3.1 Routine Tests

1. High Voltage (H.V.)
2. Insulation Resistance (I.R.)
3. Functional

#### 4.3.2 Type Tests

1. Enclosure Class Test



## SPECIFICATION FOR LOCAL PANELS

|                                          |                   |      |
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### 5.0 SPARES AND CONSUMABLES

#### 5.1 Commissioning Spares and consumables

The bidder shall supply all commissioning spares and consumables 'as required' during Start-up, as part of the main equipment supply.

#### 5.2. Mandatory Spares

The bidder shall offer along with main offer, the Mandatory Spares as specified elsewhere in the specification. The Mandatory Spares offered shall be of the same make and type as the main equipment.

#### 5.3. Recommended Spares

The bidder shall furnish a list of Recommended Spares indicating the normal service expectancy period and frequency of replacement; quantities recommended for 3 years operation alongwith unit rate against each item to enable BHEL/BHEL's Customer to place a separate order later, if required.

### 6.0 DRAWINGS AND DOCUMENTS

#### 6.1 The bidder shall furnish the following documents in required number of copies along with the bid:

1. Data Sheet no. PES-145A-DS1-0
2. General Arrangement Drawing.
3. Catalogue and technical information for instruments and devices.
4. Quality Plan.

#### 6.2 The vendor shall furnish the following documents in required number as agreed after the award of contract:

1. Data Sheet No. PES-145A-DS2-0
2. GA Drawing indicating layout of instruments, construction details, foundation details, cable gland plate along with cable glands and all details mentioned in this specification.
3. Control Schematic Diagram along with grouping of different terminals for various functions.
4. Catalogue and technical information for instruments and devices with selected options clearly marked.
5. O&M Manuals.
6. "As Built" Drawing.
7. CDs.

### 7.0 MARKING AND PACKING

#### 7.1 Panel with all instruments / devices mounted on it shall be suitably packed & protected for the entire period of dispatch, storage and erection against impact, abrasion, corrosion, incidental damage due to vermin, sunlight, high temperature, rain moisture, humidity, dust, sea-water spray (where applicable) as well as rough handling and delays in Transit and storage in open.

### 8.0 APPLICABLE DATA SHEET FORMS

This document shall be read with one or more of the following data sheet forms:

- |                                   |   |                               |
|-----------------------------------|---|-------------------------------|
| - Data sheet A&B for Local Panels | : | Data sheet no. PES-145A-DS1-0 |
| - Data sheet C for Local Panels   | : | Data sheet no. PES-145A-DS2-0 |



# DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS-999-145-054A

VOLUME

SECTION

REV. NO.

DATE: 05.12.2017

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TAG No. .... Qty.....

Data Sheet No.: PES-145A-DS1-0

## Data Sheet A & B

DATA SHEET-A FOR LOCAL PANEL  
(TO BE FILLED BY PURCHASER)

DATA SHEET-B  
(TO BE FILLED-UP BY  
BIDDER)

|                  |                                                                                         |                                                                                          |                                                                                                                                                                                                    |
|------------------|-----------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>GENERAL</b>   | MANUFACTURER                                                                            |                                                                                          |                                                                                                                                                                                                    |
|                  | CONSTRUCTION                                                                            |                                                                                          | <input checked="" type="checkbox"/> FOLDED <input type="checkbox"/> WELDED                                                                                                                         |
|                  | ENCLOSURE SHEET THICKNESS                                                               | FRONT                                                                                    | <input checked="" type="checkbox"/> 2.0 mm                                                                                                                                                         |
|                  |                                                                                         | OTHER                                                                                    | <input checked="" type="checkbox"/> 2.0 mm                                                                                                                                                         |
|                  |                                                                                         | DOOR                                                                                     | <input checked="" type="checkbox"/> 2.0 mm                                                                                                                                                         |
|                  |                                                                                         | HEIGHT                                                                                   | <input checked="" type="checkbox"/> 2365 mm for stand-alone panels                                                                                                                                 |
| OTHER            |                                                                                         | <input checked="" type="checkbox"/> Load bearing sheet front shall have 3.0 mm thickness |                                                                                                                                                                                                    |
| <b>TECHNICAL</b> | INPUT POWER SUPPLY<br>(ANY OTHER POWER REQUIREMENT TO BE DERIVED FROM THIS SUPPLY ONLY) |                                                                                          | <input checked="" type="checkbox"/> 240 V AC (Supply feeder)/ 415V 3 PHASE 4W<br><input type="checkbox"/> 415V 3 PHASE 3W<br>Kindly refer electrical scope between BHEL & Vendor                   |
|                  | NO. OF FEEDERS                                                                          |                                                                                          | <input type="checkbox"/> ONE <input type="checkbox"/> TWO<br>Kindly refer electrical scope between BHEL & Vendor                                                                                   |
|                  | STARTER WITH MCC                                                                        |                                                                                          | <input checked="" type="checkbox"/> REQUIRED (IN VENDOR'S CONTROL PANEL)<br><input type="checkbox"/> NOT REQUIRED                                                                                  |
|                  | IPR POSITION                                                                            |                                                                                          | <input checked="" type="checkbox"/> STARTER CUM CONTROL PANEL (IN VENDOR'S SCOPE)                                                                                                                  |
|                  | CONTACT RATING OF RELAY                                                                 |                                                                                          | <input checked="" type="checkbox"/> 5 Amp, 230 V AC <input checked="" type="checkbox"/> 0.25 Amp, 220V DC                                                                                          |
|                  | CONTROL SUPPLY                                                                          |                                                                                          | <input type="checkbox"/> 110V AC <input type="checkbox"/> 220V AC<br><input type="checkbox"/> 220V DC <input type="checkbox"/> Other.<br>(As per requirement, to be decided during detailed engg.) |
|                  | ALARM ANNUNCIATOR WINDOW<br>(EXCLUDING SPARES)                                          |                                                                                          | Shall be decided during detailed Engg.                                                                                                                                                             |
|                  | TEMP SCANNER                                                                            |                                                                                          | <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED                                                                                                                 |
|                  | MIMIC (TYPE OF MIMIC- MATERAIL, THICKNESS TO BE SPECIFIED DURING DETAILED ENGG. )       |                                                                                          | <input type="checkbox"/> REQUIRED <input checked="" type="checkbox"/> NOT REQUIRED                                                                                                                 |
|                  | PAINT TYPE                                                                              |                                                                                          | FOR PAINT TYPE & COLOR: -<br>REFER Cl. No. B0.6.9 – SIGNS & COLOUR CODE<br>GIVEN UNDER CUSTOMER SPECIFICATION B0.                                                                                  |
|                  | PANEL COLOUR (EXTERNAL)                                                                 |                                                                                          |                                                                                                                                                                                                    |
|                  | FINISH (EXTERNAL)                                                                       |                                                                                          |                                                                                                                                                                                                    |
|                  | PANEL COLOUR (INTERNAL)                                                                 |                                                                                          |                                                                                                                                                                                                    |
|                  | FINISH (INTERNAL)                                                                       |                                                                                          |                                                                                                                                                                                                    |
|                  | CLASS OF PROTECTION                                                                     |                                                                                          | REFER Cl. No. B0.6.18.4 of Customer spec B0                                                                                                                                                        |
|                  | CONTROL HARDWARE                                                                        |                                                                                          | <input checked="" type="checkbox"/> Push buttons along with status indications                                                                                                                     |
|                  | FOUNDATION ARRANGEMENT                                                                  |                                                                                          | <input type="checkbox"/> FOUNDATION BOLTS <input type="checkbox"/> ANCHOR FASTENERES                                                                                                               |
|                  | WEIGHT OF PANEL (Kg.)                                                                   |                                                                                          | .....(Vendor to specify )                                                                                                                                                                          |
|                  | PANEL TYPE                                                                              |                                                                                          | <input type="checkbox"/> PRESSURISED <input checked="" type="checkbox"/> UNPRESSURISED                                                                                                             |
|                  | CABLE GLAND                                                                             |                                                                                          | <input checked="" type="checkbox"/> DOUBLE COMPRESSION<br>Kindly refer electrical scope between BHEL & Vendor                                                                                      |
|                  | AMMETER (TYPE OF INPUT)                                                                 |                                                                                          | <input type="checkbox"/> 1 Amp CT <input type="checkbox"/> 4-20 mA                                                                                                                                 |
|                  | SCOPE OF SUPERVISION FOR ERECTION & COMMISSIONING                                       |                                                                                          | <input type="checkbox"/> APPLICABLE <input checked="" type="checkbox"/> NA                                                                                                                         |



# DATA SHEET FOR LOCAL PANELS

SPECIFICATION NO.: PE-SS-999-145-054A

VOLUME

SECTION

REV. NO.

02

DATE: 05.12.2017

SHEET

2

OF

2

TAG No. .... Qty.....

Data Sheet No.: **PES-145A-DS1-0**

## Data Sheet C

DATA SHEET-C FOR LOCAL PANEL  
(TO BE FILLED BY CONTRACTOR AFTER AWARD OF CONTRACT)

|                  |                                                |        |                                 |                                 |
|------------------|------------------------------------------------|--------|---------------------------------|---------------------------------|
| <b>GENERAL</b>   | MANUFACTURER                                   |        |                                 |                                 |
|                  | CONSTRUCTION                                   |        | <input type="checkbox"/> FOLDED | <input type="checkbox"/> WELDED |
|                  | ENCLOSURE SHEET THICKNESS                      | FRONT  |                                 |                                 |
|                  |                                                | OTHER  |                                 |                                 |
|                  |                                                | DOOR   |                                 |                                 |
|                  |                                                | HEIGHT |                                 |                                 |
|                  |                                                | OTHER  |                                 |                                 |
| <b>TECHNICAL</b> | INPUT POWER SUPPLY                             |        |                                 |                                 |
|                  | NO. OF FEEDERS                                 |        |                                 |                                 |
|                  | CONTACT RATING OF RELAY                        |        |                                 |                                 |
|                  | TEMP SCANNER                                   |        |                                 |                                 |
|                  | CONTROL SUPPLY                                 |        |                                 |                                 |
|                  | ALARM ANNUNCIATOR WINDOW<br>(EXCLUDING SPARES) |        |                                 |                                 |
|                  | PAINT TYPE                                     |        |                                 |                                 |
|                  | PANEL COLOUR (EXTERNAL)                        |        |                                 |                                 |
|                  | FINISH (EXTERNAL)                              |        |                                 |                                 |
|                  | TYPE OF MIMIC                                  |        |                                 |                                 |
|                  | MATERIAL OF MIMIC                              |        |                                 |                                 |
|                  | THICKNESS OF MIMIC                             |        |                                 |                                 |
|                  | PANEL COLOUR (INTERNAL)                        |        |                                 |                                 |
|                  | FINISH (INTERNAL)                              |        |                                 |                                 |
|                  | CLASS OF PROTECTION                            |        |                                 |                                 |
|                  | CONTROL HARDWARE                               |        |                                 |                                 |
|                  | FOUNDATION ARRANGEMENT                         |        |                                 |                                 |
|                  | WEIGHT OF PANEL (Kg.)                          |        |                                 |                                 |
|                  | PANEL TYPE                                     |        |                                 |                                 |
|                  | CABLE GLAND                                    |        |                                 |                                 |
|                  | AMMETER (TYPE OF INPUT)                        |        |                                 |                                 |
|                  | SCOPE OF SUPERVISION                           |        |                                 |                                 |



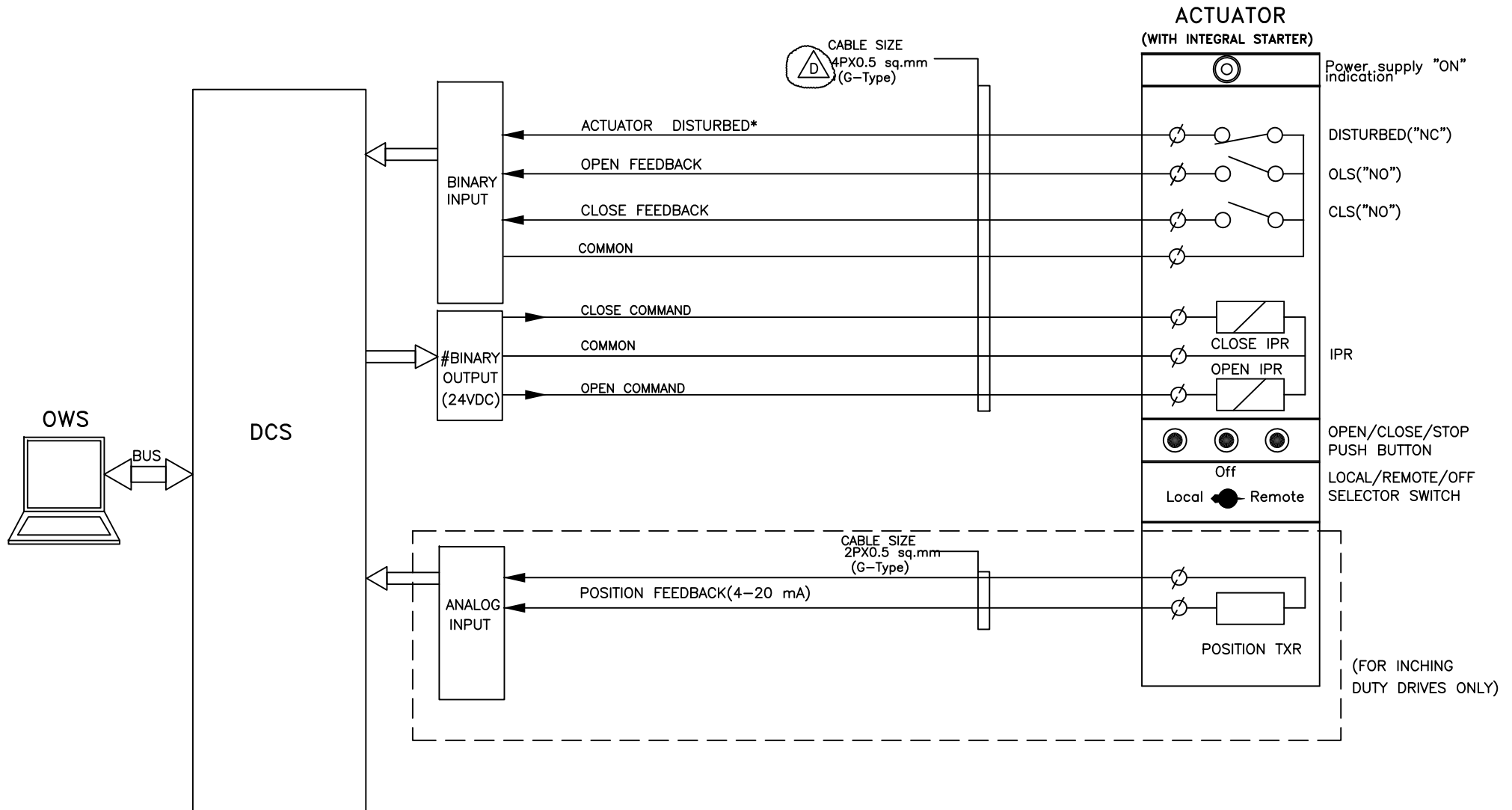
Technical specification  
for  
**2X660 MW MAITREE STPP, BANGLADESH**

SECTION: D

REV. NO. 00 DATE : 05.12.2017

## **DRIVE CONTROL PHILOSOPHY**

# DCS INTERFACE FOR BIDIRECTIONAL DRIVE(WITH INTEGRAL STARTER)



## NOTE:

- \* DISTURBED= Loss of Power supply (1 Phase/3 Phase)/  
Loss of control supply/ Motor thermostat trip/  
Thermal over load/  
Local/Off/Remote Sel. switch in local or off mode/  
Stop PB optd.

#BINARY=  
OUTPUT

# Redundant output shall be provided



PROJECT: 2X660MW BIFPCL MAITREE

TITLE

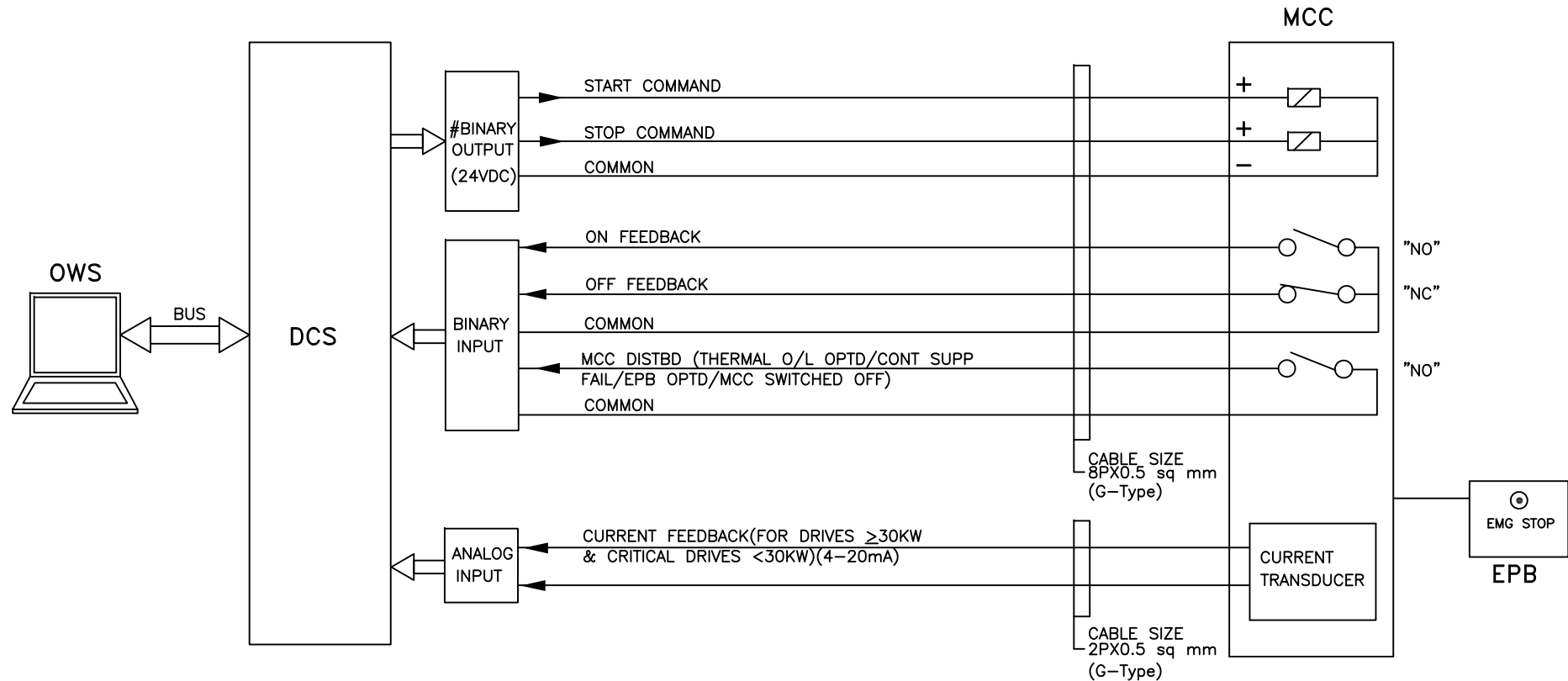
DDCMIS INTERFACE FOR  
BIDIRECTIONAL DRIVE

DRG.NO. Maitree-01-CD-FF-  
123002-PEM-D

DATE 10.08.2017

SHT 7 OF 11

# DCS INTERFACE FOR UNIDIRECTIONAL LT DRIVE



NOTE:

#BINARY=  
OUTPUT

# Redundant output shall be provided



PROJECT: 2X660MW BIFPCL MAITREE

TITLE

DDCMIS INTERFACE FOR  
UNIDIRECTIONAL LT DRIVE

DRG.NO. Maitree-01-CD-FF-  
123002-PEM-D

DATE 10.08.2017

SHT 8 OF 11



Technical specification  
for

2X660MW STPP, MAITREE-BANGLADESH

SECTION D

REV. NO. 00

DATE : 05.12.2017

## APPLICABLE C&I CABLE TYPES



Technical specification  
for  
**2X660MW STPP, MAITREE-BANGLADESH**

SECTION D

REV. NO.

00

DATE : 05.12.2017

| S. No.        | C&I Cable Type  |
|---------------|-----------------|
|               |                 |
| G-TYPE        |                 |
| 1             | 2P X 0.5 sq.mm  |
| 2             | 4P X 0.5 sq.mm  |
| 3             | 8P X 0.5 sq.mm  |
| 4             | 12P X 0.5 sq.mm |
|               |                 |
| F-TYPE        |                 |
| 1             | 4P X 0.5 sq.mm  |
| 2             | 8P X 0.5 sq.mm  |
| 3             | 12P X 0.5 sq.mm |
| 4             | 20P X 0.5 sq.mm |
|               |                 |
| CONTROL CABLE |                 |
| 1             | 3C X 2.5 sq.mm  |



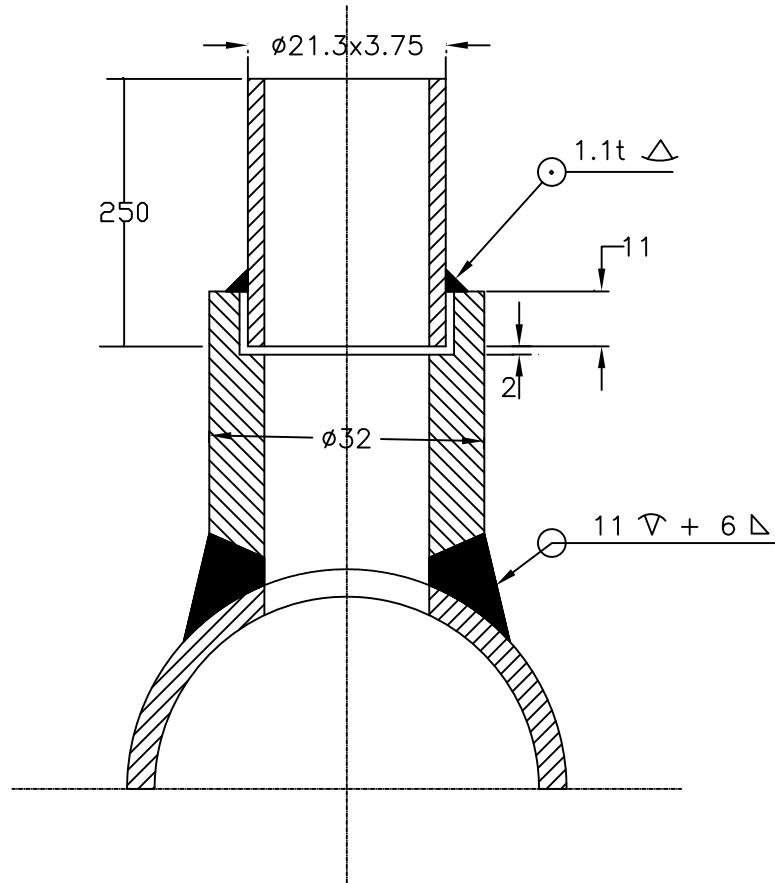
Technical specification  
for  
**2X660 MW MAITREE STPP, BANGLADESH**

SECTION: D

REV. NO. 00

DATE : 05.12.2017

# INSTRUMENT STUB DETAILS



#### NOTE :

1. MATERIAL OF THE BOSS AND NIPPLE SHALL BE THE SAME AS THE PIPE INTO WHICH IT IS WELDED AND CONFORM TO ANSI B16.11.
2. THE LENGTH OF NIPPLE SHOULD BE 250 MM.
3. STUB LENGTH SHALL BE 64mm UPTO 200Nb PIPE, 45mm ABOVE 200Nb PIPE SIZE.
4. STUB AND NIPPLE SHALL HAVE IBR CERTIFICATION, AS APPLICABLE, ACCORDING TO PROCESS DATA



TITLE :  
**INSTRUMENT STUB DETAILS**  
**FOR PRESSURE MEASUREMENT**  
 (SYSTEM PRESS UPTO 40Kg/Cm<sup>2</sup>, CLASS 3000#)

DRG. NO.

REV. 00



Technical specification  
for  
**2X660 MW MAITREE STPP, BANGLADESH**

SECTION: D

REV. NO. 00

DATE : 05.12.2017

# **INSTRUMENT INSTALLATION DIAGRAM**

## INSTALLATION NOTES

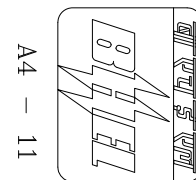
01. HORIZONTAL PIPE RUNS SHALL HAVE A SLOPE OF 50 MM'S IN ONE METER

02. LEGEND/ABBREVIATIONS USED IN THE INSTALLATION SCHEMES.

- A/R : AS REQUIRED
- PT : PRESSURE TRANSMITTER
- DPT : DIFFERENTIAL PRESSURE TRANSMITTER ( FT or LT or DPT type ).
- DFDC : DOUBLE FERRULE DOUBLE COMPRESSION
- INST : INSTRUMENT

03. DRAIN PIPE INSIDE LIE / LIR SHALL BE OF A106 Gr. C– 2" NB Sch. 80 ALONGWITH WITH SUITABLE ADAPTER / ELBOW ON ONE SIDE & CAP ON OTHER SIDE.

04. DRAIN FROM LIE / LIR SHALL BE CONNECTED TO NEAREST PLANT DRAIN THROUGH OPEN FUNNEL ( 1/2" SIZE ).

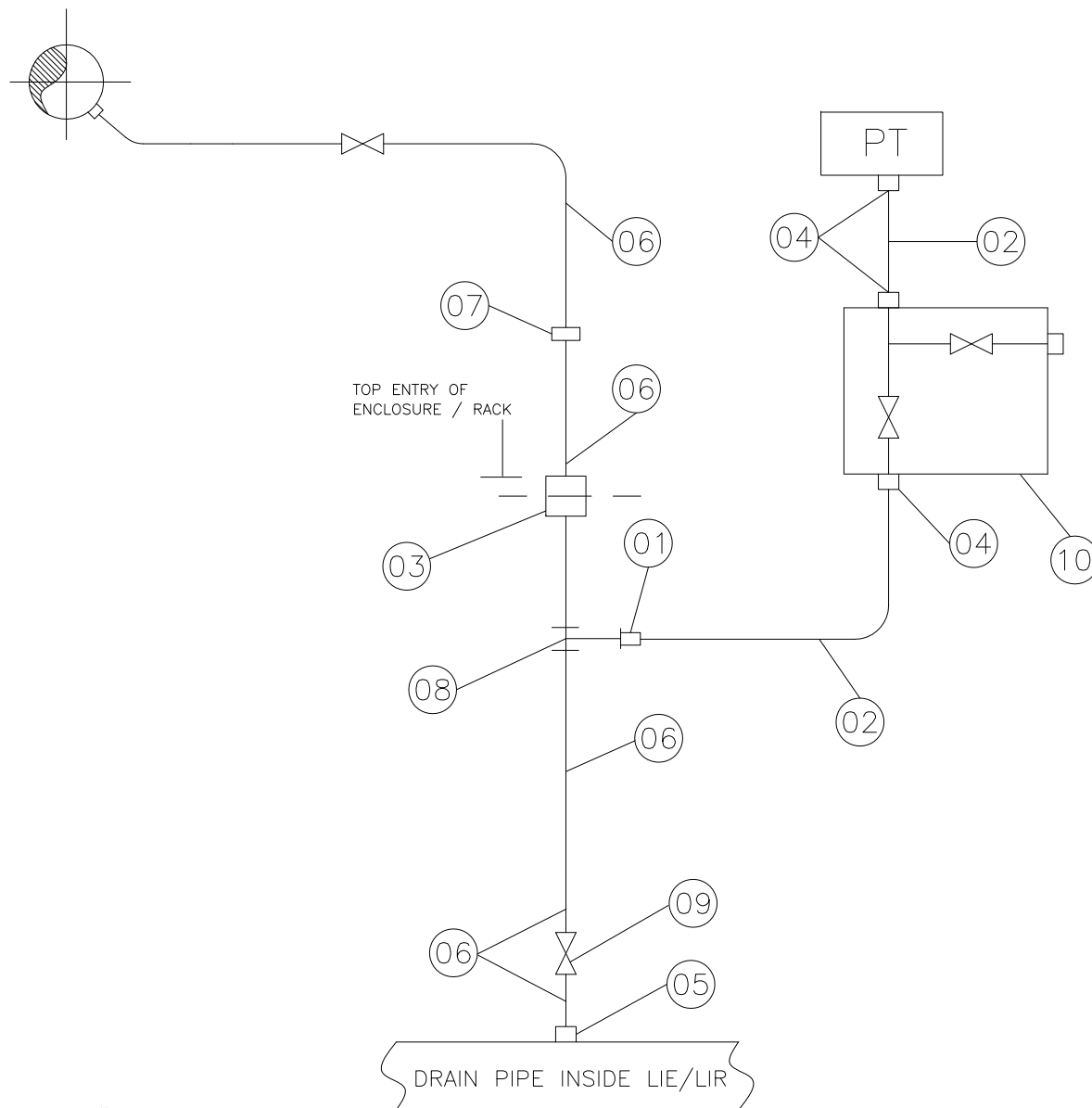
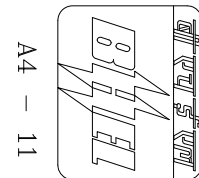


A4 – 11

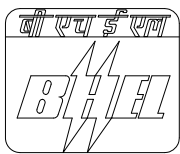
PE-DG-421-145-1555

REV. NO. 00

PAGE : 02

NOTE:

1. " TRANSMITTER BELOW SOURCE"
2. FOR BILL OF MATERIAL REFER PAGE 8



A4 - 11

PE-DG-421-145-I555

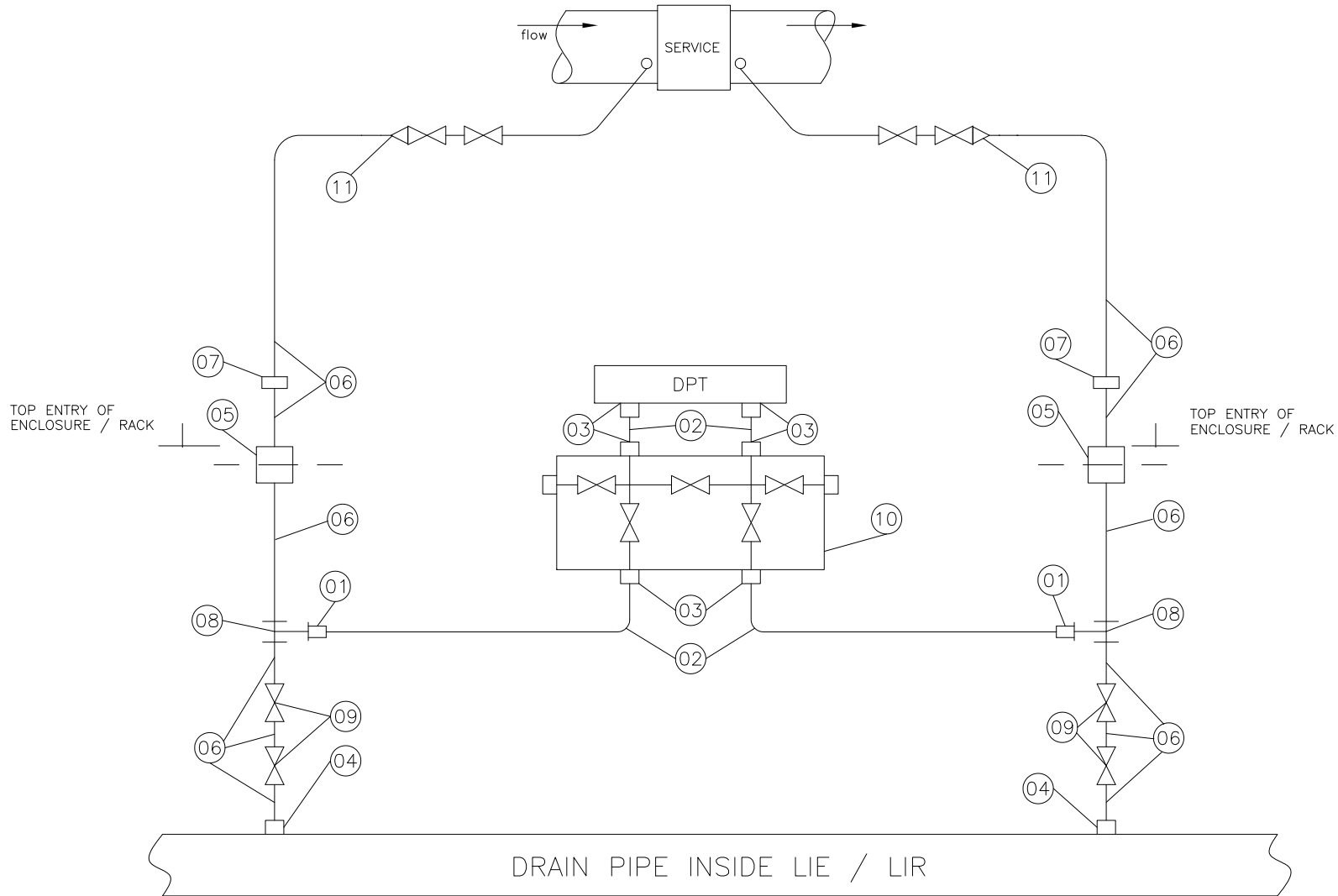
REV. NO. 00

PAGE : 8

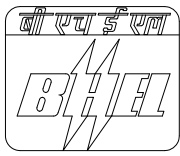
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|          |                                                                                                    |           |
|----------|----------------------------------------------------------------------------------------------------|-----------|
| 10       | TWO VALVE MANIFOLD WITH VENT PLUG<br>PORT SIZE : 1/2" NPTF / MATL : SS316<br>PR. TESTING : 3000PSI | 01        |
| 09       | FORGED GLOBE VALVE<br>BODY : ASTM A105<br>SIZE : 1/2" NB-SW / CL : 800                             | 01        |
| 08       | FORGED TEE / AS PER ANSI B16.11<br>MATL. : ASTM A105<br>SIZE : 1/2" NB-SW / CL : 3000              | 01        |
| 07       | FORGED COUPLING / AS PER ANSI B16.11<br>MATL : ASTM A105<br>SIZE : 1/2" NB-SW / CL. 3000           | A/R       |
| 06       | IMPULSE PIPE<br>MATL : ASTM A106 Gr. C<br>SIZE : 1/2" NB-SCH 80                                    | A/R       |
| 05       | HALF COUPLING / 1/2" NB-SW /AS PER ANSI B16.11<br>MATL : ASTM A105 /CL. 3000                       | 01        |
| 04       | TUBE FITTING / DFDC<br>MATL. : SS316<br>SIZE : 1/2" NPTM X TO SUIT 1/2" OD SS TUBE                 | 03        |
| 03       | BULK HEAD UNION / COUPLING<br>CL : 3000 LBS / 1/2" NB-SW<br>MATL : ASTM A105/AS PER ANSI B16.11    | 1No.      |
| 02       | TUBE / MATL. : SS316 ASTM A 213 TP 316 H<br>SIZE : 1/2" OD X 2.1 mm THK.                           | A/R       |
| 01       | TEE TUBE UNION / MATL. : SS316<br>SIZE : OD OF 1/2" NB - PIPE X<br>TO SUIT TO 1/2" OD SS TUBE      | 01        |
| ITEM NO. | ITEM DESCRIPTION                                                                                   | QTY/INST. |

**NOTE:**

1. " TRANSMITTER BELOW SOURCE"
2. FOR BILL OF MATERIAL REFER PAGE 10



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PE-DG-421-145-I555

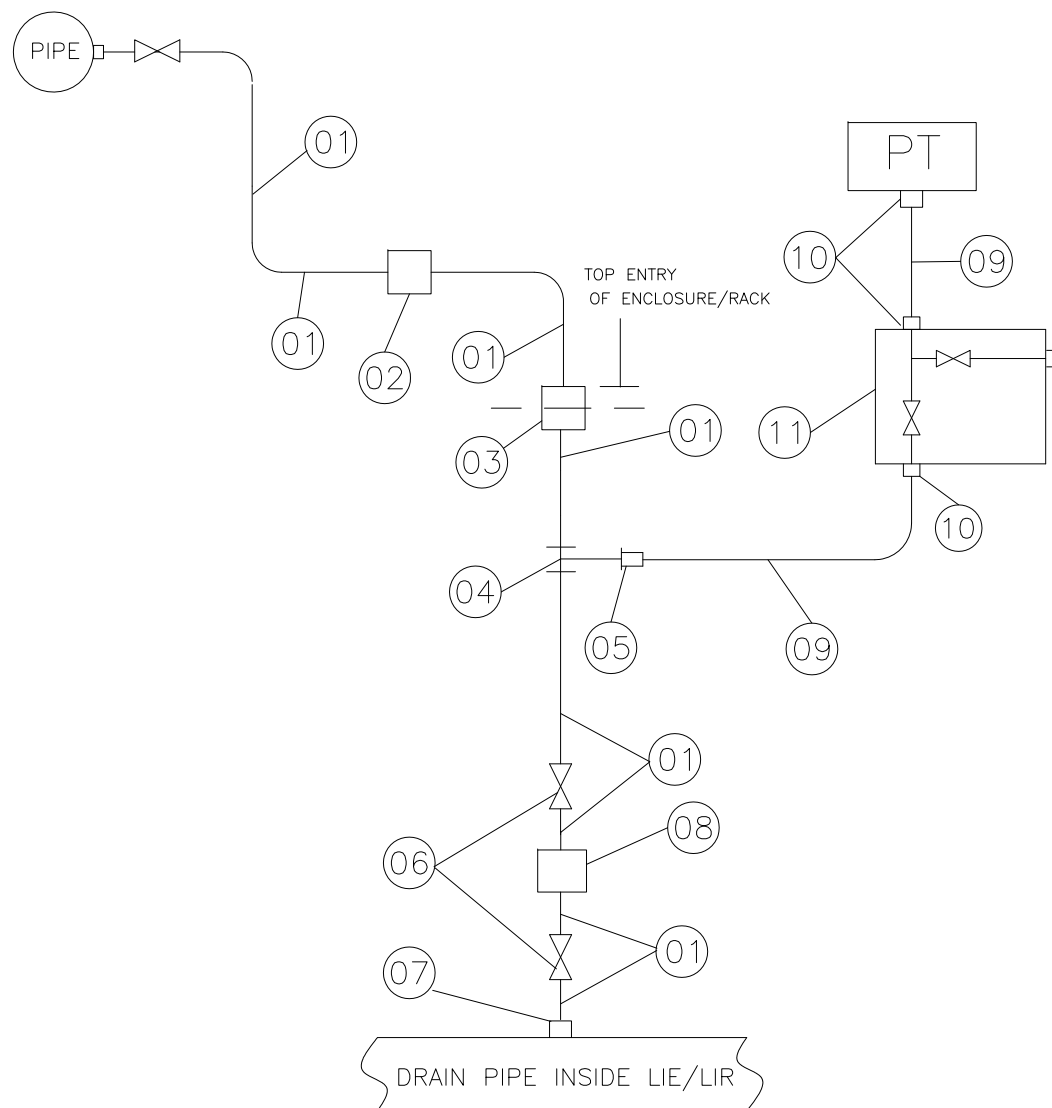
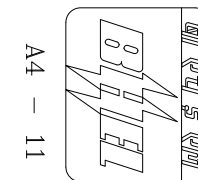
REV. NO. 00

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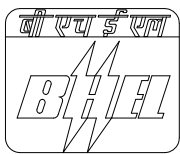
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|             |                                                                                                      |           |
|-------------|------------------------------------------------------------------------------------------------------|-----------|
| 11          | FORGED REDUCER / AS PER ANSI B16.11<br>MATL.: ASTM A105<br>SIZE: OD OF 1" NB TO 1/2" NB - SW CL 6000 | 02        |
| 10          | FIVE VALVE MANIFOLD WITH VENT PLUG<br>PORT SIZE : 1/2" NPTF / MATL. : SS316<br>PR. TESTING : 6000PSI | 01        |
| 09          | FORGED GLOBE VALVE<br>BODY MATL. : ASTM A105<br>SIZE : 1/2" NB-SW / CL. 2500                         | 04        |
| 08          | FORGED TEE / AS PER ANSI B16.11<br>MATL. ASTM A105<br>SIZE : 1/2" NB-SW /CL : 6000                   | 02        |
| 07          | FORGED COUPLING / AS PER ANSI B16.11<br>MATL. : ASTM A105<br>SIZE : 1/2" NB-SW / CL. 6000            | A/R       |
| 06          | IMPULSE PIPE<br>MATL. ASTM A106 Gr.C<br>SIZE : 1/2" NB-SCH 160                                       | A/R       |
| 05          | BULK HEAD UNION COUPLING / AS PER ANSI B16.11<br>MATL. : ASTM A105/ 1/2" NB-SW<br>CL : 6000          | 02        |
| 04          | HALF COUPLING / AS PER ANSI B16.11<br>MATL. : ASTM A105 / 1/2" NB-SW /CL.6000                        | 02        |
| 03          | TUBE FITTING / DFDC<br>MATL. : SS316<br>SIZE : 1/2" NPTM X TO SUIT 1/2" OD SS TUBE                   | 06        |
| 02          | TUBE / MATL. : ASTM A 213 TP 316 H<br>SIZE : 1/2" OD X 2.1 THK.                                      | A/R       |
| 01          | TEE- TUBE UNION<br>MATL. : SS316 / SIZE : OD OF 1/2" NB X<br>TO SUIT 1/2" OD SS TUBE                 | 02        |
| ITEM<br>NO. | ITEM DESCRIPTION                                                                                     | QTY/INST. |

NOTE:

1. " TRANSMITTER BELOW SOURCE"
2. FOR BILL OF MATERIAL REFER PAGE 16



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PE-DG-421-145-I555

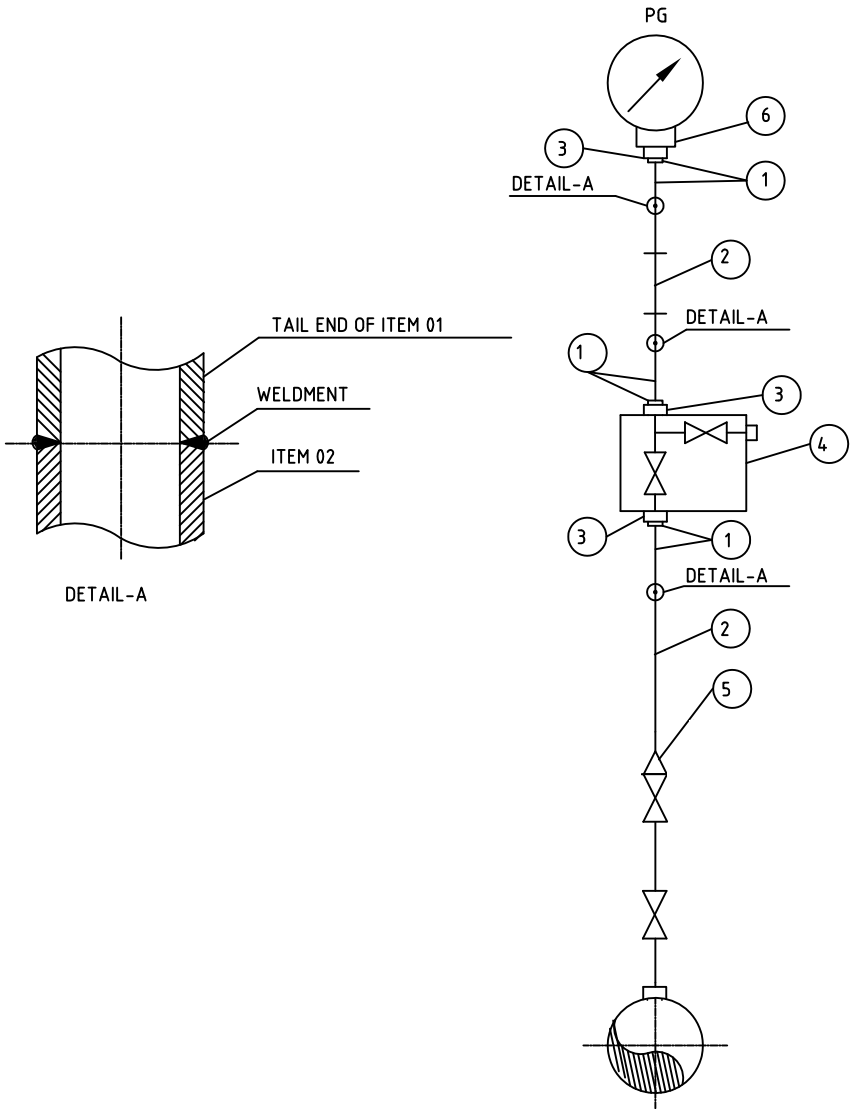
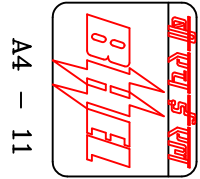
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|          |                                                                                                                |           |
|----------|----------------------------------------------------------------------------------------------------------------|-----------|
| 11       | TWO VALVE MANIFOLD + VENT PLUG / PR.TESTING: 3000 PSI<br>MATL. : SS316, PORT SIZE : 1/2" NPTF                  | 01        |
| 10       | TUBE FITTING/DFDC/, MATL. : SS316<br>SIZE : 1/2" NPTM x TO SUIT 1/2" OD SS TUBE.                               | 03        |
| 09       | TUBE MATL. : ASTM A213 TP 316 H<br>SIZE : 1/2" OD x 1.13 mm THK.                                               | A/R       |
| 08       | DRAIN POT: 2" NB Sch 80<br>BODY: A106 Gr. C / CONN. 3/4" NB - SW                                               | 01        |
| 07       | HALF COUPLING / 3/4" NB-SW /AS PER ANSI B16.11<br>MATL : ASTM A105 /CL. 3000                                   | 01        |
| 06       | GLOBE VALVE / CL. 800<br>SIZE : 3/4" NB-SW<br>BODY: ASTM A105                                                  | 02        |
| 05       | TEE TUBE UNION; MATL. : SS316<br>SIZE : OD OF 3/4" NB PIPE x SUIT TO 1/2" OD - TUBE<br>RATING : 3000           | 01        |
| 04       | FORGED EQUAL TEE/AS PER ANSI B16.11/RATING : CL 3000<br>SIZE : 3/4" NB-SW ; MATL. : ASTM A105                  | 01        |
| 03       | FORGED BULK HEAD UNION / AS PER ANSI B16.11<br>RATING : ANSI CL. 3000<br>SIZE : 3/4" NB - SW/MATL. : ASTM A105 | 01        |
| 02       | FORGED COUPLING/AS PER ANSI B16.11<br>SIZE : 3/4" NB - SW / RATING : ANSI CL 3000<br>MATL. : ASTM A105         | A/R       |
| 01       | IMPULSE PIPE; SIZE : 3/4" NB - SCH 80<br>MATL. : ASTM A106 Gr. C                                               | A/R       |
| ITEM NO. | ITEM DESCRIPTION                                                                                               | QTY/INST. |



| ITEM No. | ITEM DESCRIPTION                                                                                               | QUANTITY/INST. (Nos.) |
|----------|----------------------------------------------------------------------------------------------------------------|-----------------------|
| 1        | NUT & TAIL FITTING + COPPER WASHERS<br>MATL : ASTM A105 / SIZE: NUT : 3/4" BSPF<br>TAIL : ID= 9 mm / OD= 19 mm | 03                    |
| 2        | IMPULSE PIPE<br>SIZE : 1/2" NB - SCH 160<br>MATL : ASTM A106 Gr.C                                              | A/R                   |
| 3        | ADAPTER<br>MATL:ASTM A105<br>SIZE : 1/2" NPTM x 3/4" BSPM                                                      | 03                    |
| 4        | TWO VALVE VALVE MANIFOLD+VENT PLUG<br>RATING : 6000 LBS/ MATL: SS304<br>PORT CONNECTION : 1/2" NPTF            | 01                    |
| 5        | FORGED REDUCER/ RATING CL. 6000LBS<br>SIZE: OD of 1" NB x 1/2" NB-SW/AS PER ANSI B16.11<br>SMATL : ASTM A105   | 01                    |
| 6 ##     | SNUBBER<br>MATL. ASTM A105<br>SIZE : 1/2" NPTM X 1/2" NPTF<br>FLOW DIRECTION- 1/2" NPTF TO 1/2" NPTM           | 01                    |

## ONLY FOR SERVICES WITH PULSATING FLOW ( DISCHARGE SERVICES)

NOTE :-  
1. PRESSURE INDICATOR MOUNTED LOCAL AT SOURCE



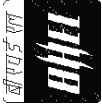
Technical specification  
for  
**2X660 MW MAITREE STPP, BANGLADESH**

REV. NO.

00

DATE : 05.12.2017

# **QUALITY PLAN LOCAL CONTROL PANEL**



STD QUALITY PLAN NO.: PE-QP-999-145-I056

VOLUME IIB

SECTION D

REV. NO. 01 DATE: 22-02-2008

SHEET 1 OF 7

STANDARD QUALITY PLAN

FOR

LOCAL CONTROL PANEL

PEM :: C&I

| Sl. No. | Component / operation               | Characteristics Checked     | * Category | Type/Method of Check | Extent of Check | Reference documents              | Acceptance Norms                 | Format of Records | Agency \$ |     |     |  | Remarks |
|---------|-------------------------------------|-----------------------------|------------|----------------------|-----------------|----------------------------------|----------------------------------|-------------------|-----------|-----|-----|--|---------|
|         |                                     |                             |            |                      |                 |                                  |                                  |                   | P         | W   | V   |  |         |
| 1.0     | INCOMING<br>Sheet Steel (CRCA & HR) | 1. Chemical Composition     | MA         | Chemical analysis    | Sample          | Relevant standard                | Relevant standard                | Test Certificate  | 3         | --- | 2   |  |         |
|         |                                     | 2. Bend Test                | CR         | Mech. test           | Sample          | Relevant standard                | Relevant standard                | Log Book          | 2         | --- | --- |  |         |
|         |                                     | 3. Surface finish           | MA         | Visual               | 100%            | Factory Standard / Sample        | Factory Standard / Sample        | Log Book          | 2         | --- | --- |  |         |
|         |                                     | 4. Waviness                 | MA         | Visual               | 100%            | Factory Standard                 | No Waviness                      | Log Book          | 2         | --- | --- |  |         |
|         |                                     | 5. Thickness                | MA         | Measurement          | 100%            | BHEL Spec.                       | BHEL Spec.                       | Log Book          | 2         | --- | --- |  |         |
|         |                                     | 6. Mill marking             | MA         | Visual               | 100%            | Factory Standard                 | Factory Standard                 | Log Book          | 2         | --- | 1   |  |         |
| 2.0     | Flats / Angles / Channels           | 1. Dimensions               | MA         | Measurement          | Sample          | Relevant standard                | Relevant standard                | Log Book          | 2         | --- | --- |  |         |
|         |                                     | 2. Surface Defects          | MA         | Visual               | 100%            | Factory Standard / Sample        | Factory Standard / Sample        | Log Book          | 2         | --- | --- |  |         |
|         |                                     | 3. Straightness             | MA         | Measurement          | 100%            | Factory Std.                     | Factory Std.                     | Log Book          | 2         | --- | --- |  |         |
|         |                                     | 4. Mill marking             | MA         | Visual               | 100%            | Relevant standard                | Relevant standard                | Log Book          | 2         | --- | 1   |  |         |
| 3.0     | Cables / Wires                      | 1. Visual / Surface defects | MA         | Visual               | 100%            | BHEL Spec. and Relevant standard | BHEL Spec. and Relevant standard | Log Book          | 2         | --- | --- |  |         |
|         |                                     | 2. IR and HV                | MA         | Electrical           | 100%            | BHEL Spec. and Relevant standard | BHEL Spec. and Relevant standard | Log Book          | 2         | --- | --- |  |         |

LEGEND: \* CR - Critical characteristics

MA - Major characteristics

MI - Minor characteristics

\$

P - Agency Performing the Test.

W - Agency Witnessing the Test.

V - Agency Verifying the Test.

1 - BHEL

2 - Vendor

3 - Sub-vendor



PEM :: C&I

# STANDARD QUALITY PLAN FOR LOCAL CONTROL PANEL

|                       |                    |
|-----------------------|--------------------|
| STD QUALITY PLAN NO.: | PE-OP-999-145-I056 |
|-----------------------|--------------------|

|        |     |
|--------|-----|
| VOLUME | IIB |
|--------|-----|

SECTION

|          |    |                  |
|----------|----|------------------|
| REV. NO. | 01 | DATE: 22-02-2008 |
|----------|----|------------------|

SHEET 2 OF 7

| Sl. No. | Component / operation                                                                                                                           | Characteristics Checked                                     | * Category     | Type/Method of Check             | Extent of Check      | Reference documents              | Acceptance Norms                 | Format of Records | Agency's |     |     | Remarks                                                                           |
|---------|-------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|----------------|----------------------------------|----------------------|----------------------------------|----------------------------------|-------------------|----------|-----|-----|-----------------------------------------------------------------------------------|
|         |                                                                                                                                                 |                                                             |                |                                  |                      |                                  |                                  |                   | P        | W   | V   |                                                                                   |
| 4.0     | Electrical Components like Annunciator Transformers Lamps Switches PBs Contactors Relays Timers Space Heaters Thermostat Indicating meters etc. | 3. Conductor<br>a) Resistance<br>b) Size<br>c) Sheet colour | MA<br>MA<br>MA | Electrical Measurement<br>Visual | 100%<br>100%<br>100% | BHEL Spec. and Relevant standard | BHEL Spec. and Relevant standard | Log Book          | 2        | --- | --- | + for relay & contactors only<br>@ for all components except relays & contactors. |
|         |                                                                                                                                                 | 4. Type / Routine Test Certificates                         | MA             | Verification                     | 100%                 | BHEL Spec. and Relevant standard | BHEL Spec. and Relevant standard | Log Book          | 3        | --- | 2   |                                                                                   |
|         |                                                                                                                                                 | 1. Verification at make and Type                            | CR             | Visual                           | Sample               | BHEL Spec. and BOM               | BHEL Spec. and BOM               | Log Book          | 2        | --- | --- |                                                                                   |
|         |                                                                                                                                                 | 2. Verification of Test Certificates                        | CR             | Scrutiny of Type / Routine T.Cs. | 100%                 | Relevant standard                | Relevant standard                | Log Book          | 2        | --- | --- |                                                                                   |
|         |                                                                                                                                                 | 3. Operation / Functional check                             | CR             | Electrical                       | Sample+ 100%@        | Relevant standard & Catalogue    | Relevant standard & Catalogue    | Log Book          | 2        | --- | --- |                                                                                   |
|         |                                                                                                                                                 | 4. I.R.                                                     | MA             | Electrical                       | 100%                 | Relevant standard & Catalogue    | Relevant standard & Catalogue    | Log Book          | 2        | --- | --- |                                                                                   |
|         |                                                                                                                                                 | 5. H.V.                                                     | MA             | Electrical                       | 100%                 | Relevant standard & Catalogue    | Relevant standard & Catalogue    | Log Book          | 2        | --- | --- |                                                                                   |
|         |                                                                                                                                                 | 6. Calibration                                              | MA             | Electrical                       | 100%                 | Relevant standard & Catalogue    | Relevant standard & Catalogue    | Log Book          | 2        | --- | 1   |                                                                                   |
|         |                                                                                                                                                 | 7. Pick up / Drop off Voltage                               | MA             | Electrical                       | 100%                 | Relevant standard & Catalogue    | Relevant standard & Catalogue    | Log Book          | 2        | --- | --- |                                                                                   |

LEGEND: \* CR - Critical characteristics  
MA - Major characteristics  
MI - Minor characteristics

- P - Agency Performing the Test.
- W - Agency Witnessing the Test.
- V - Agency Verifying the Test.

- 1 - BHEL
- 2 - Vendor
- 3 - Sub-vendor



| STANDARD QUALITY PLAN<br>FOR<br>LOCAL CONTROL PANEL                                                     |                            |                                                            |            |                                                 |                 |                                      |                                      |                   |           | STD QUALITY PLAN NO.: PE-QP-999-145-I056 |         |     |  |                  |  |
|---------------------------------------------------------------------------------------------------------|----------------------------|------------------------------------------------------------|------------|-------------------------------------------------|-----------------|--------------------------------------|--------------------------------------|-------------------|-----------|------------------------------------------|---------|-----|--|------------------|--|
|                                                                                                         |                            |                                                            |            |                                                 |                 |                                      |                                      |                   |           | VOLUME                                   |         | IIB |  |                  |  |
|                                                                                                         |                            |                                                            |            |                                                 |                 |                                      |                                      |                   |           | SECTION                                  |         | D   |  |                  |  |
|                                                                                                         |                            |                                                            |            |                                                 |                 |                                      |                                      |                   |           | REV. NO.                                 |         | 01  |  | DATE: 22-02-2008 |  |
|                                                                                                         |                            |                                                            |            |                                                 |                 |                                      |                                      |                   |           | SHEET                                    |         | 4   |  | OF 7             |  |
| Sl. No.                                                                                                 | Component / operation      | Characteristics Checked                                    | * Category | Type/Method of Check                            | Extent of Check | Reference documents                  | Acceptance Norms                     | Format of Records | Agency \$ |                                          | Remarks |     |  |                  |  |
|                                                                                                         |                            |                                                            |            |                                                 |                 |                                      |                                      |                   | P         | W                                        | V       |     |  |                  |  |
| 9.0                                                                                                     | Pre-treatment and Painting | 1. Pretreatment Process                                    | MA         | Visual                                          | 100%            | Factory Standard & Relevant standard | Factory Standard & Relevant standard | Log Book          | 2         | ---                                      | 1       |     |  |                  |  |
|                                                                                                         |                            | 2. Process parameters like bath temp. concentration etc.   | MA         | Measurement                                     | Periodic        | Factory Standard & Relevant standard | Factory Standard & Relevant standard | Log Book          | 2         | ---                                      | 1       |     |  |                  |  |
|                                                                                                         |                            | 3. Dipping / Removal Time                                  | MA         | Measurement                                     | 100%            | Factory Standard & Relevant standard | Factory Standard & Relevant standard | Log Book          | 2         | ---                                      | 1       |     |  |                  |  |
|                                                                                                         |                            | 4. Surface quality after every dip                         | MA         | Visual                                          | 100%            | Factory Standard & Relevant standard | Factory Standard & Relevant standard | Log Book          | 2         | ---                                      | 1       |     |  |                  |  |
|                                                                                                         |                            | 5. Primer after phosphating                                | MA         | Visual, Thickness                               | 100%            | Factory Standard & Relevant standard | Factory Standard & Relevant standard | Log Book          | 2         | ---                                      | 1       |     |  |                  |  |
|                                                                                                         |                            | 6. Putty Application & Rubbing after primer                | MA         | Visual                                          | 100%            | Factory Standard & Relevant standard | Factory Standard & Relevant standard | Log Book          | 2         | ---                                      | 1       |     |  |                  |  |
|                                                                                                         |                            | 7. Paint first coat                                        | MA         | Visual, Thickness                               | 100%            | Factory Standard & Relevant standard | Factory Standard & Relevant standard | Log Book          | 2         | ---                                      | 1       |     |  |                  |  |
|                                                                                                         |                            | 8. Putty Application and Rubbing after first coat of paint | MA         | Visual                                          | 100%            | Factory Standard & Relevant standard | Factory Standard & Relevant standard | Log Book          | 2         | ---                                      | 1       |     |  |                  |  |
|                                                                                                         |                            | 9. Paint second coat                                       | MA         | Visual, Thickness, Scratch test Colour adhesion | 100%            | Factory Standard & Relevant standard | Factory Standard & Relevant standard | Log Book          | 2         | ---                                      | 1       |     |  |                  |  |
| LEGEND: * CR - Critical characteristics<br>MA - Major characteristics<br>MI - Minor characteristics     |                            |                                                            |            |                                                 |                 |                                      |                                      |                   |           |                                          |         |     |  |                  |  |
| \$ P - Agency Performing the Test.<br>W - Agency Witnessing the Test.<br>V - Agency Verifying the Test. |                            |                                                            |            |                                                 |                 |                                      |                                      |                   |           |                                          |         |     |  |                  |  |
| 1 - BHBL<br>2 - Vendor<br>3 - Sub-vendor                                                                |                            |                                                            |            |                                                 |                 |                                      |                                      |                   |           |                                          |         |     |  |                  |  |



PEM :: C&I

STANDARD QUALITY PLAN  
FOR  
LOCAL CONTROL PANEL

STD QUALITY PLAN NO.: PE-QP-999-145-I056

VOLUME IIB

SECTION D

REV. NO. 01 DATE: 22-02-2008

SHEET 5 OF 7

| Sl. No. | Component / operation     | Characteristics Checked                                                                                                                                                   | * Category | Type/Method of Check | Extent of Check | Reference documents          | Acceptance Norms             | Format of Records | Agency \$ |     |     |     | Remarks                                                         |
|---------|---------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------|-----------------|------------------------------|------------------------------|-------------------|-----------|-----|-----|-----|-----------------------------------------------------------------|
|         |                           |                                                                                                                                                                           |            |                      |                 |                              |                              |                   | P         | W   | V   |     |                                                                 |
| 10.     | Panel Wiring              | 1. Wiring Layout<br>2. Wiring Termination (Crimped Lugs)<br>3. Ferrule numbers<br>4. Colour of wiring<br>5. Size of Conductor                                             | MA         | Visual               | 100%            | Approved drgs. & Specs.      | Approved drgs. & Specs.      | Log Book          | 2         | --- | --- | --- |                                                                 |
|         |                           |                                                                                                                                                                           | MA         | Visual               | 100%            | Approved drgs. & Specs.      | Approved drgs. & Specs.      | Log Book          | 2         | --- | --- | --- |                                                                 |
|         |                           |                                                                                                                                                                           | MA         | Visual               | 100%            | Approved drgs. & Specs.      | Approved drgs. & Specs.      | Log Book          | 2         | --- | --- | --- |                                                                 |
|         |                           |                                                                                                                                                                           | MA         | Visual               | 100%            | Approved drgs. & Specs.      | Approved drgs. & Specs.      | Log Book          | 2         | --- | --- | 1   |                                                                 |
|         |                           |                                                                                                                                                                           | MA         | Measurement          | 100%            | Approved drgs. & Specs.      | Approved drgs. & Specs.      | Log Book          | 2         | --- | --- | 1   |                                                                 |
| 11.     | Component Mounting        | 1. Correct components<br>2. Fixing                                                                                                                                        | MA         | Visual               | 100%            | Approved drgs., Specs. & BOM | Approved drgs., Specs. & BOM | Log Book          | 2         | --- | --- | --- |                                                                 |
|         |                           |                                                                                                                                                                           | MA         | Visual               | 100%            | Approved drgs., Specs. & BOM | Approved drgs., Specs. & BOM | Log Book          | 2         | --- | --- | --- |                                                                 |
| 12.     | FINAL<br>Final Inspection | 1. Workmanship<br>2. Component layout (neatness, accessibility & safety) Mounting / Proper fixing of all components<br>3. Components identification Marking / Name plates | MA         | Visual               | 100%            | Factory Standard             | Factory Standard             | Inspection Report | 2         | 1   | 1   | 1   | At Random by BHEL, based on 100 % internal test reports by Mfr. |
|         |                           |                                                                                                                                                                           | MA         | Visual               | 100%            | BHEL approved drg. / Spec.   | BHEL approved drg. / Spec.   | Inspection Report | 2         | 1   | 1   | 1   |                                                                 |
|         |                           |                                                                                                                                                                           | MA         | Visual               | 100%            | BHEL approved drg. / Spec.   | BHEL approved drg. / Spec.   | Inspection Report | 2         | 1   | 1   | 1   |                                                                 |

LEGEND: \* CR - Critical characteristics

MA - Major characteristics

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2 - Vendor

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|                                                                                     |                       |                                                     |            |                      |                 |                                 |                                 |                   |                     |   |   |                                                                 |  |  |  |
|-------------------------------------------------------------------------------------|-----------------------|-----------------------------------------------------|------------|----------------------|-----------------|---------------------------------|---------------------------------|-------------------|---------------------|---|---|-----------------------------------------------------------------|--|--|--|
|  |                       | STANDARD QUALITY PLAN<br>FOR<br>LOCAL CONTROL PANEL |            |                      |                 |                                 |                                 |                   |                     |   |   | STD QUALITY PLAN NO.: <b>PE-QP-999-145-I056</b>                 |  |  |  |
| Sl. No.                                                                             | Component / operation | Characteristics Checked                             | * Category | Type/Method of Check | Extent of Check | Reference documents             | Acceptance Norms                | Format of Records | Agency <sup>s</sup> |   |   | SHEET 6 OF 7                                                    |  |  |  |
|                                                                                     |                       | 5. Dimensions                                       | MA         | Measurement          | 100%            | BHEL approved drg. / Spec., BOM | BHEL approved drg. / Spec., BOM | Inspection Report | 2                   | 1 | 1 | At Random by BHEL, based on 100 % internal test reports by Mfr. |  |  |  |
|                                                                                     |                       | 6. Door functioning                                 | MA         | Functional           | 100%            | BHEL approved drg. / Spec.      | BHEL approved drg. / Spec.      | Inspection Report | 2                   | 1 | 1 |                                                                 |  |  |  |
|                                                                                     |                       | 7. Paint Shade                                      | CR         | Visual               | 100%            | BHEL approved drg. / Spec.      | BHEL approved drg. / Spec.      | Inspection Report | 2                   | 1 | 1 |                                                                 |  |  |  |
|                                                                                     |                       | 8. Paint Thickness                                  | CR         | Measurement          | 100%            | BHEL approved drg. / Spec.      | BHEL approved drg. / Spec.      | Inspection Report | 2                   | 1 | 1 |                                                                 |  |  |  |
|                                                                                     |                       | 9. Workmanship of Gaskets                           | MA         | Visual               | 100%            | Factory Standard                | Factory Standard                | Inspection Report | 2                   | 1 | 1 |                                                                 |  |  |  |
|                                                                                     |                       | 10. Wiring Layout                                   | MA         | Visual               | 100%            | BHEL approved drg.              | BHEL approved drg.              | Inspection Report | 2                   | 1 | 1 |                                                                 |  |  |  |
|                                                                                     |                       | 11. Wire Termination                                | MA         | Pulling manually     | Sample          | -----                           | Firm termination                | Inspection Report | 2                   | 1 | 1 |                                                                 |  |  |  |
|                                                                                     |                       | 12. Continuity                                      | MA         | Electrical           | 100%            | -----                           | Continuity OK                   | Inspection Report | 2                   | 1 | 1 |                                                                 |  |  |  |

|                                                                                                     |  |          |  |                                          |  |  |
|-----------------------------------------------------------------------------------------------------|--|----------|--|------------------------------------------|--|--|
| LEGEND: * CR - Critical characteristics<br>MA - Major characteristics<br>MI - Minor characteristics |  | \$ P W V |  | 1 - BHEL<br>2 - Vendor<br>3 - Sub-vendor |  |  |
|                                                                                                     |  |          |  |                                          |  |  |





Technical specification  
for  
**2X660 MW MAITREE STPP, BANGLADESH**

REV. NO.

00

DATE : 05.12.2017

# **INSTRUMENTS CHECK LIST**



Technical specification  
for  
**2X660 MW MAITREE STPP, BANGLADESH**

REV. NO. 00 DATE : 05.12.2017

Important notes for Quality assurance and checks shall be as follows:

- 1) The requirement indicated in the check list is minimal. Vendor has to submit Quality Plans/ Checklists for addressing the minimal requirement indicated in the check list and also those indicated under **clause B0.7** in the specification under **Section-IA**- customer's General Technical Specification – B0, as relevant to instruments. Vendor submitted quality plans shall be subject to customer approval during detail engineering without any commercial and time implication. For instruments for which checklist is not attached, vendor's Quality Plan for such items will also be subject to customer approval during detail engineering without any commercial and delivery implication.
- 2) The inspection agencies indicated in the Checklists in specification may be ignored. These will be aligned in line with approved Inspection categorization plan during detail engineering without any commercial and delivery implication.



## STANDARD CHECK LIST FOR C&I INSTRUMENTS

### CHECK LIST FOR TRANSMITTER

| Sl. No. | Test / Checks                        | Quantum of check | Reference Doc. / Acceptance Norms | Agency ** |   |   | Remarks |
|---------|--------------------------------------|------------------|-----------------------------------|-----------|---|---|---------|
|         |                                      |                  |                                   | M         | C | B |         |
| 1       | CHECKS FOR                           | SEE NOTE-1 BELOW | APPROVED SPEC./ DATA SHEETS       | P         | W | V |         |
|         | VISUAL.                              |                  |                                   |           |   |   |         |
|         | MODEL/TAG No                         |                  |                                   |           |   |   |         |
| 2       | PROCESS CONNECTION                   |                  |                                   | P         | W | V |         |
| 3       | ACCURACY                             |                  |                                   | P         | W | V |         |
| 4       | REPEATABILITY                        |                  |                                   | P         | W | V |         |
| 5       | HYSTERESIS                           |                  |                                   | P         | W | V |         |
| 6       | EFFECT OF TEMP VARIATION ON ACCURACY |                  |                                   | P         | W | V |         |
| 7       | SPAN / ZERO ADJUSTMENT               | ONE / TYPE       |                                   | P         | W | V |         |
| 8       | EFFECT OF SUPPLY VOLTAGE VARIATION   |                  |                                   | P         | W | V |         |
| 9       | EFFECT OF LOADING (500 OHM METERS)   |                  |                                   | P         | W | V |         |
| 10      | HIGH PRESSURE TEST                   | SEE NOTE-1 BELOW |                                   | P         | W | V |         |
| 11      | BURN-IN TEST                         | ONE / TYPE       |                                   | P         | W | V |         |
| 12      | DEGREE OF PROTECTION                 |                  |                                   | P         | W | V |         |
| 13      | ACCESSORIES AS APPLICABLE            | SEE NOTE-1 BELOW |                                   | V         | V | V |         |

#### Legend :

\*\* M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

#### Note :

- Quantum of check shall be as below :  
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- When material corelation are not available manufacturer's compliance to be provided.
- Contractor to provide compliance certificate for tests/checks verifid by contractor and submit the same alongwith test certificates to be verified by BHEL.



## STANDARD CHECK LIST FOR C&I INSTRUMENTS

### CHECK LIST FOR PRESSURE & DP GAUGE

| Sl. No. | Test / Checks                         | Quantum of check | Reference Doc. / Acceptance Norms | Agency ** |   |   | Remarks |
|---------|---------------------------------------|------------------|-----------------------------------|-----------|---|---|---------|
|         |                                       |                  |                                   | M         | C | B |         |
| 1       | CHECK FOR                             | SEE NOTE-1 BELOW | APPROVED SPEC./ DATA SHEETS       | P         | W | V |         |
|         | SENSOR TYPE                           |                  |                                   |           |   |   |         |
|         | DIAL SIZE                             |                  |                                   |           |   |   |         |
|         | MODEL NO/TAG NO                       |                  |                                   |           |   |   |         |
|         | RANGE/SCALE                           |                  |                                   |           |   |   |         |
|         | SWITCH CONTACT RATING & NOS.          |                  |                                   |           |   |   |         |
|         | END CONNECTION                        |                  |                                   |           |   |   |         |
| 2       | CALIBRATION                           |                  |                                   | P         | W | V |         |
|         | ACCURACY                              |                  |                                   |           |   |   |         |
|         | REPEATABILITY                         |                  |                                   |           |   |   |         |
|         | SET POINT ADJUSTMENT                  |                  |                                   |           |   |   |         |
| 3       | OVER PRESSURE & LEAK TEST             | P                |                                   | W         | V |   |         |
| 4       | OPERATION OF PRESSURE. RELIEF DEVICE  | ONE              |                                   | P         | W | V |         |
| 5       | REVIEW OF TC FOR                      | FOR LOT          |                                   | V         | V | V |         |
|         | MATERIALS OF SENSOR                   |                  |                                   |           |   |   |         |
|         | MOVEMENT                              |                  |                                   |           |   |   |         |
|         | PROCESS CONNECTION                    |                  |                                   |           |   |   |         |
|         | HOUSING                               |                  |                                   |           |   |   |         |
| 6       | REVIEW OF TC FOR DEGREE OF PROTECTION | TYPE TEST        | V                                 | V         | V |   |         |
| 7       | ACCESSORIES AS APPLICABLE             | SEE NOTE-1 BELOW | V                                 | V         | V |   |         |
|         |                                       |                  |                                   |           |   |   |         |
|         |                                       |                  |                                   |           |   |   |         |
|         |                                       |                  |                                   |           |   |   |         |
|         |                                       |                  |                                   |           |   |   |         |

#### Legend :

\*\* M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL,  
P = Perform, W = Witness, V = Verification

#### Note :

- Quantum of check shall be as below :  
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- When material correlation is not available, MFR's compliance to be provided
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.



## STANDARD CHECK LIST FOR C&I INSTRUMENTS

### CHECK LIST FOR ANNUNCIATORS

| Sl. No. | Test / Checks                                 | Quantum of check | Reference Doc. / Acceptance Norms | Agency ** |   |   | Remarks |
|---------|-----------------------------------------------|------------------|-----------------------------------|-----------|---|---|---------|
|         |                                               |                  |                                   | M         | C | B |         |
| 1       | CHECK FOR                                     | SEE NOTE-1 BELOW | APPROVED SPEC./ DATA SHEETS       | P         | W | V |         |
|         | TYPE/ MODEL                                   |                  |                                   |           |   |   |         |
|         | DIMENSIONS OF HARDWARE                        |                  |                                   |           |   |   |         |
|         | MODULARITY                                    |                  |                                   |           |   |   |         |
|         | SEQUENCE                                      |                  |                                   |           |   |   |         |
|         | FACIA DETAILS                                 |                  |                                   |           |   |   |         |
| 2       | FUNCTIONAL TEST                               | 100%             |                                   | P         | W | V |         |
| 3       | IMMUNE TO STEP VARIATIONS IN THE POWER SUPPLY | SEE NOTE-1 BELOW |                                   | P         | W | V |         |
| 4       | DEGREE OF PROTECTION FOR ENCLOSURE            | TYPE TEST        |                                   | P         | W | V |         |
| 5       | I/R CHECK                                     | SEE NOTE-1 BELOW |                                   | P         | W | V |         |
| 6       | RESPONSE                                      |                  |                                   | P         | W | V |         |
|         |                                               |                  |                                   |           |   |   |         |
|         |                                               |                  |                                   |           |   |   |         |
|         |                                               |                  |                                   |           |   |   |         |
|         |                                               |                  |                                   |           |   |   |         |
|         |                                               |                  |                                   |           |   |   |         |
|         |                                               |                  |                                   |           |   |   |         |
|         |                                               |                  |                                   |           |   |   |         |
|         |                                               |                  |                                   |           |   |   |         |

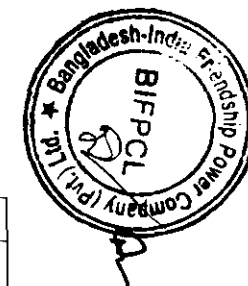
#### Legend :

\*\* M = Manufacturer / Sub-contractor, C = Contractor / Nominated Inspecting Agency, B = BHEL, P = Perform, W = Witness, V = Verification

#### Note :

- Quantum of check shall be as below :  
100 % - By Manufacturer
- Manufacturer to maintain calibrated instrument having better accuracy than the item under test. Inspecting engineer shall check the same.
- Manufacturer to carry out ROUTINE TEST on 100 %.
- Contractor to provide compliance certificate for tests/checks verified by contractor and submit the same alongwith test certificates to be verified by BHEL.

|                                                                                   |                                                                                                                                       |      |                                                                                                         |                          |       |             |                                                                 |  |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|------|---------------------------------------------------------------------------------------------------------|--------------------------|-------|-------------|-----------------------------------------------------------------|--|
|  | <b>PROJECT: MAITREE, 2X660 MW</b><br><b>PACKAGE: TG PACKAGE</b><br><b>CONTRACTOR: BHEL</b><br><b>HARIDWAR</b><br><b>CONTRACT NO.:</b> |      | <b>LIST OF ITEM SREQUIRING QUALITY PLAN AND</b><br><b>SUB CONTRACTOR APPROVAL SUB SYSTEM: C &amp; I</b> |                          |       |             | <b>REFNO.:00</b><br><b>REV NO.:00</b><br><b>Date:14.12.2015</b> |  |
|                                                                                   | SI No.                                                                                                                                | Item | LIST OF IT EMS                                                                                          | Vendor/Manufacturer Name | Place | SC A PP L_S | Remarks                                                         |  |

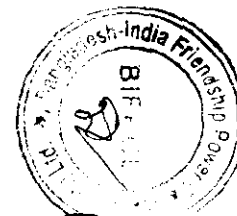


|    |                                                        |     |  |                                 |                          |    |              |
|----|--------------------------------------------------------|-----|--|---------------------------------|--------------------------|----|--------------|
| 2. | Thermocouples                                          | *   |  | SiemensLimited                  | Gurgaon                  | DR |              |
| 3. | Fibre optic Gen End Winding VibrationMonitoring System | II  |  | Vibro System INC                | Canada                   | A  | Refer Note 1 |
| 3. | Fibre optic Gen End Winding VibrationMonitoring System | II  |  | MC-Monitoring SA                | Switzerland              | A  | Refer Note 2 |
| 3. | Fibre optic Gen End Winding VibrationMonitoring System | *   |  | SiemensLimited                  | Gurgaon                  | DR |              |
| 4. | Level Switch (Float/Displacer Type)                    | III |  | Chemtrols Samil                 | Mumbai                   | A  |              |
| 4. | Level Switch (Float/Displacer Type)                    | III |  | Pune Techtrols                  | Pune                     | A  |              |
| 4. | Level Switch (Float/Displacer Type)                    | III |  | Levcon Instruments              | Kolkata                  | A  |              |
| 4. | Level Switch (Float/Displacer Type)                    | III |  | SBEM                            | Pune                     | A  |              |
| 4. | Level Switch (Float/Displacer Type)                    | III |  | SiemensLimited                  | Gurgaon                  | A  |              |
| 4. | Level Switch (Float/Displacer Type)                    | III |  | DKInstruments                   | Kolkata                  | A  |              |
| 4. | Level Switch (Float/Displacer Type)                    | III |  | V Automat&Instruments           | NewDelhi                 | A  |              |
| 4. | Level Switch (Float/Displacer Type)                    | III |  | Magnetrol Instruments           | Belgium                  | A  |              |
| 4. | Level Switch (Float/Displacer Type)                    | III |  | Endress& Hauser Instruments     | Switzerland / Aurangabad | A  |              |
| 4. | Level Switch (Float/Displacer Type)                    | *   |  | Pratolina Instruments           | Mumbai                   | DR |              |
| 5. | Pressure/Differential Pressure Gauge                   | III |  | Manometer India                 | Mumbai                   | A  |              |
| 5. | Pressure/Differential Pressure Gauge                   | III |  | H Guru Instruments(South India) | Bangalore                | A  |              |

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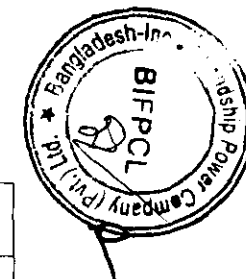
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|                   |                                                                                                               |                                                                                                   |  |                                 |              |                            |                |
|-------------------|---------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|--|---------------------------------|--------------|----------------------------|----------------|
|                   | <b>PROJECT: MAITREE, 2X660 MW<br/>PACKAGE: TG PACKAGE<br/>CONTRACTOR: BHEL<br/>HARIDWAR<br/>CONTRACT NO.:</b> | <b>LIST OF ITEM SREQUIRING QUALITY PLAN AND<br/>SUB CONTRACTOR APPROVAL SUB SYSTEM: C &amp; I</b> |  |                                 |              | <b>REFNO.:00</b>           |                |
|                   |                                                                                                               |                                                                                                   |  |                                 |              | <b>REV NO.:00</b>          |                |
|                   |                                                                                                               |                                                                                                   |  |                                 |              | <b>Date:14.12.2015</b>     |                |
| <b>SI<br/>No.</b> | <b>Item</b>                                                                                                   | <b>LIST<br/>OFIT<br/>EMS</b>                                                                      |  | <b>Vendor/Manufacturer Name</b> | <b>Place</b> | <b>SC_A<br/>PP<br/>L_S</b> | <b>Remarks</b> |

|    |                                      |     |  |                                |                       |    |  |
|----|--------------------------------------|-----|--|--------------------------------|-----------------------|----|--|
| 5. | Pressure/Differential Pressure Gauge | III |  | H Guru Instruments             | Muzaffarpur<br>Risra  | A  |  |
| 5. | Pressure/Differential Pressure Gauge | III |  | FISCHER MESS &<br>REGELTECHNIK | Germany               | A  |  |
| 5. | Pressure/Differential Pressure Gauge | III |  | Baumer Technologies            | Vapi                  | A  |  |
| 5. | Pressure/Differential Pressure Gauge | III |  | GluckIndia                     | Mumbai                | A  |  |
| 5. | Pressure/Differential Pressure Gauge | III |  | A N Instruments                | Narendrapur           | A  |  |
| 5. | Pressure/Differential Pressure Gauge | III |  | Ashcroft                       | Gandhinagar           | A  |  |
| 5. | Pressure/Differential Pressure Gauge | III |  | Wika Instruments               | Pune                  | A  |  |
| 5. | Pressure/Differential Pressure Gauge | III |  | NSRT                           | Kolkata               | A  |  |
| 5. | Pressure/Differential Pressure Gauge | III |  | PTCI                           | Kolkata               | A  |  |
| 5. | Pressure/Differential Pressure Gauge | *   |  | Siemens Limited                | Gurgaon               | DR |  |
| 5. | Pressure/Differential Pressure Gauge | III |  | Walchand nagar Industries      | Attikolla,<br>Dharwad | A  |  |
| 5. | Pressure/Differential Pressure Gauge | *   |  | New Scientific Repairs & Tradi | KOLKATA               | DR |  |

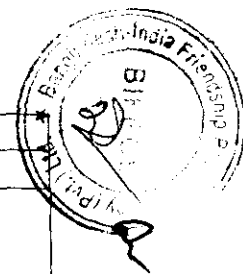
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|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|-------------|---------------------------------------------------------------------------------------------------------|---------------------------------|--------------|--------------------|-----------------------------------------------------------------|--|
|  | <b>PROJECT: MAITREE, 2X660 MW</b><br><b>PACKAGE: TG PACKAGE</b><br><b>CONTRACTOR: BHEL</b><br><b>HARIDWAR</b><br><b>CONTRACT NO.:</b> |             | <b>LIST OF ITEM SREQUIRING QUALITY PLAN AND</b><br><b>SUB CONTRACTOR APPROVAL SUB SYSTEM: C &amp; I</b> |                                 |              |                    | <b>REFNO.:00</b><br><b>REV NO.:00</b><br><b>Date:14.12.2015</b> |  |
|                                                                                   | <b>SI No.</b>                                                                                                                         | <b>Item</b> | <b>LIST OF IT EMS</b>                                                                                   | <b>Vendor/Manufacturer Name</b> | <b>Place</b> | <b>SC A PP L_S</b> | <b>Remarks</b>                                                  |  |



|    |                                      |     |  |                               |                     |    |                          |
|----|--------------------------------------|-----|--|-------------------------------|---------------------|----|--------------------------|
| 5. | Pressure/Differential Pressure Gauge | *   |  | Forbes Marshall (Hyd) Pvt Ltd | IDA Nacharam, Medak | DR |                          |
| 6. | Pressure/DP/Flow Transmitters        | II  |  | ABB Limited                   | Bangalore           | A  | 2600 T series            |
| 6. | Pressure/DP/Flow Transmitters        | II  |  | Emerson Process Management    | Pawane              | A  |                          |
| 6. | Pressure/DP/Flow Transmitters        | III |  | Fuji Electric System          | Japan /China        | A  |                          |
| 6. | Pressure / D P / Flow Transmitters   | II  |  | Laxsons Automation            | Daman               | A  | M/s Smar Brazil Make     |
| 6. | Pressure/DP/Flow Transmitters        | III |  | ABB Utility Automation        | Germany             | A  | 2600 T series            |
| 6. | Pressure/DP/Flow Transmitters        | III |  | Yokogawa India                | Bangalore           | A  | Make M/s Yokogawa, Japan |
| 6. | Pressure/DP/Flow Transmitters        | III |  | Siemens Limited               | Thane               | A  |                          |
| 6. | Pressure/DP/Flow Transmitters        | *   |  | Chino corporation India       | Ghaziabad           | DR |                          |
| 7. | Instrumentation Cables               | II  |  | Paramount Communication       | Khuskhera           | A  | For PVC, FRLS            |
| 7. | Instrumentation Cables               | II  |  | KEI industries                | Bhiwadi             | A  | For PVC, FRLS            |
| 7. | Instrumentation Cables               | II  |  | Delton Cables                 | Faridabad           | A  | For PVC, FRLS            |
| 7. | Instrumentation Cables               | II  |  | Cords Cables                  | Bhiwadi             | A  | For PVC, FRLS            |
| 7. | Instrumentation Cables               | II  |  | Elkay Telelinks               | New Delhi           | A  | For PVC, FRLS            |
| 7. | Instrumentation Cables               | II  |  | Universal Cables              | Satna               | A  | For PVC, FRLS            |

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|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|--|---------------------------------|--------------|------------------------|----------------|
|  | <b>PROJECT: MAITREE, 2X660 MW</b><br><b>PACKAGE: TG PACKAGE</b><br><b>CONTRACTOR: BHEL</b><br><b>HARIDWAR</b><br><b>CONTRACT NO.:</b> | <b>LIST OF ITEM SREQUIRING QUALITY PLAN AND</b><br><b>SUB CONTRACTOR APPROVAL SUB SYSTEM: C &amp; I</b> |  |                                 |              | <b>REFNO.:00</b>       |                |
|                                                                                   |                                                                                                                                       |                                                                                                         |  |                                 |              | <b>REV NO.:00</b>      |                |
|                                                                                   |                                                                                                                                       |                                                                                                         |  |                                 |              | <b>Date:14.12.2015</b> |                |
| <b>SI No.</b>                                                                     | <b>Item</b>                                                                                                                           | <b>LIST OF IT EMS</b>                                                                                   |  | <b>Vendor/Manufacturer Name</b> | <b>Place</b> | <b>SC_A PP L_S</b>     | <b>Remarks</b> |

|    |                                                        |     |  |                            |                     |    |                                                                                                                                          |
|----|--------------------------------------------------------|-----|--|----------------------------|---------------------|----|------------------------------------------------------------------------------------------------------------------------------------------|
| 7. | Instrumentation Cables                                 | II  |  | NICCO Corporation          | Kolkata             | A  | For PVC, FRLS                                                                                                                            |
| 7. | Instrumentation Cables                                 | II  |  | Thermo Cables Ltd.         | Hyderabad           | A  | For PVC, FRLS                                                                                                                            |
| 7. | Instrumentation Cables                                 | *   |  | Advance Cable Technologies | Bangalore           | DR |                                                                                                                                          |
| 7. | Instrumentation Cables                                 | *   |  | Manoj Cables Limited       | Delhi               | DR |                                                                                                                                          |
| 7. | Instrumentation Cables                                 | *   |  | Pagoda Cables Pvt. Ltd.    | Delhi               | DR |                                                                                                                                          |
| 8. | Gas Analyser Cabinet                                   | I   |  | ABB Limited                | Bangalore           | A  | H2 Analyser imported from ABB, Germany                                                                                                   |
| 8. | Gas Analyser Cabinet                                   | I   |  | Adage Automation           | Mumbai              | A  | Hydrogen Gas Analyser (Calomat 6) will be Imported from Siemens Germany                                                                  |
| 8. | Gas Analyser Cabinet                                   | I   |  | Yokogawa India             | Bangalore           | A  | Analyser will be imported from M/S Yokogawa Electric Corporation (YEC), Japan (Micro Processor based, Working on Gas Density Principle). |
| 8. | Gas Analyser Cabinet                                   | I   |  | Siemens Limited            | India               | A  | H2 Analyser imported from Siemens, Germany                                                                                               |
| 9. | Conductivity Analyser (Conduction Measuring Equipment) | *   |  | Forbes Marshall            | Pune                | DR |                                                                                                                                          |
| 9. | Conductivity Analyser (Conduction Measuring Equipment) | III |  | ABB India Limited          | Bangalore/ Dehradun | A  | Make:ABB,USA/UK                                                                                                                          |

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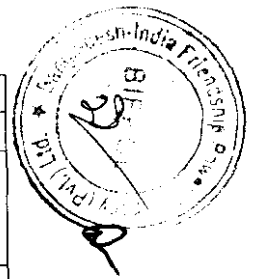
**PROJECT: MAITREE, 2X660 MW**  
**PACKAGE: TG PACKAGE**  
**CONTRACTOR: BHEL**  
**HARIDWAR**  
**CONTRACT NO.:**

**LIST OF ITEM SREQUIRING QUALITY PLAN AND  
SUB CONTRACTOR APPROVAL SUB SYSTEM: C & I**

**REFNO.:00**

**REV NO.:00**

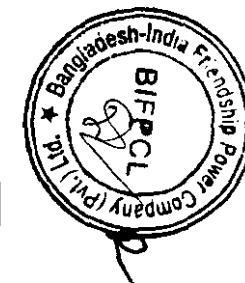
**Date:14.12.2015**



| SI No. | Item | LIST OF ITEMS |  | Vendor/Manufacturer Name | Place | SC A PP L_S | Remarks |
|--------|------|---------------|--|--------------------------|-------|-------------|---------|
|--------|------|---------------|--|--------------------------|-------|-------------|---------|

|     |                                              |     |  |                               |                          |    |                                                                                                                               |
|-----|----------------------------------------------|-----|--|-------------------------------|--------------------------|----|-------------------------------------------------------------------------------------------------------------------------------|
| 11. | Pressure / DP Switch                         | *   |  | BOLL & KIRCH                  | Germany                  | DR |                                                                                                                               |
| 11. | Pressure / DP Switch                         | *   |  | IMI Norgren Herion            | India                    | DR |                                                                                                                               |
| 11. | Pressure / DP Switch                         | *   |  | Trafag Controls India Private | Gurgaon                  | DR |                                                                                                                               |
| 12. | Capacitance type Level Transmitters/Switches | III |  | Magnetrol Instruments         | Belgium                  | A  | Application Capacitance Level Switches-Generator & Turbine Capacitance type Level Transmitters-Generator (Primary Water Tank) |
| 12. | Capacitance type Level Transmitters/Switches | III |  | Endress+Hauser Instruments    | Switzerland / Aurangabad | A  |                                                                                                                               |
| 12. | Capacitance type Level Transmitters/Switches | II  |  | NIVO Controls                 | Indore                   | A  |                                                                                                                               |
| 12. | Capacitance type Level Transmitters/Switches | II  |  | SBEM Pvt. Ltd.,               | Pune                     | A  |                                                                                                                               |
| 12. | Capacitance type Level Transmitters/Switches | *   |  | DK Instruments                | Kolkata                  | DR |                                                                                                                               |
| 13. | Guided Wave Radar Level Transmitters         | III |  | Magnetrol Instruments         | Belgium                  | A  | Application-Main Oil Tank & Control Fluid Tank                                                                                |
| 13. | Guided Wave Radar Level Transmitters         | III |  | Endress+Hauser Instruments    | Switzerland / Aurangabad | A  | Application- Main Oil Tank & Control Fluid Tank                                                                               |
| 14. | Position Transmitters                        | III |  | Siemens Limited               | Gurgaon                  | A  | Make-M/s Siemens, Germany                                                                                                     |
| 14. | Position Transmitters                        | III |  | ABB Limited                   | Bangalore/ Dehradun      | A  | Make-M/s ABB Germany                                                                                                          |
| 14. | Position Transmitters                        | III |  | Electronics Corporation       | Hyderabad                | DR |                                                                                                                               |
| 14. | Position Transmitters                        | *   |  | BI Enterprises                | Mumbai                   | DR |                                                                                                                               |

|  | <b>PROJECT: MAITREE, 2X660 MW</b><br><b>PACKAGE: TG PACKAGE</b><br><b>CONTRACTOR: BHEL</b><br><b>HARIDWAR</b><br><b>CONTRACT NO.:</b> |               | <b>LIST OF ITEM SREQUIRING QUALITY PLAN AND</b><br><b>SUB CONTRACTOR APPROVAL SUB SYSTEM: C &amp; I</b> |                            |       |             | REFNO.:00       |  |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------|----------------------------|-------|-------------|-----------------|--|
|                                                                                   |                                                                                                                                       |               |                                                                                                         |                            |       |             | REV NO.:00      |  |
|                                                                                   |                                                                                                                                       |               |                                                                                                         |                            |       |             | Date:14.12.2015 |  |
| SI No.                                                                            | Item                                                                                                                                  | LIST OF ITEMS |                                                                                                         | Vendor/Manufacturer Name   | Place | SC A PP L_S | Remarks         |  |
| 14.                                                                               | Position Transmitters                                                                                                                 | *             |                                                                                                         | Curtiss Wright Corporation | USA   | DR          |                 |  |



#### LEGENDS :

DR-Detailed Required.

CAT- I:For those items the Quality Plans are approved by BIFPCL and final acceptance will be on physical inspection witness by BIFPCL.

CAT- II : For those items the Quality Plans are approved by BIFPCL. However no physical inspection shall be done by BIFPCL. The final acceptance by BIFPCL shall be on the basis of review of documents.

CAT- III : For those items Main supplier approves Quality Plans. The final acceptance by BIFPCL shall be on the basis of Certificate of Conformance by main supplier.

\*- Inspection category will be decided during vendor evaluation.

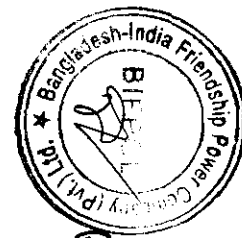
Note 1: Wired Panel along with standard bought out items like Blank panel / enclosure, accessories like Ethernet switch, Power Supply, Terminal, MCB are accepted from indigenous suppliers acceptable to BIFPCL and tied up in QP.

Note 2:For items covered in Annexure-I to B0, Part-B, Section-V, Amendment No 5 of technical specification, BHEL has to furnish the details to establish qualifying / provenness requirement to BIFPCL for review at the time of detailed engineering irrespective of the approval category "A" or "DR" mentioned in the vendor list.

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|-----|----------------------------------------|-----------------------------------------------|--------|-------------------|-----------------|-----------------------|----------------------------|--------------------|-------------------|-------------------|---------------------------------------------------------------------------------------------------------------|
|     |                                        | PROJECT : Maitree STPP (2 x 660 MW)           |        |                   |                 |                       | LIST OF ITEMS REQUIRING QP |                    |                   | REF. NO :         |                                                                                                               |
|     |                                        | PACKAGE : EPC PACKAGE                         |        |                   |                 |                       | APPROVAL & ACCEPTABLE      |                    |                   | REVISION NO : 00  |                                                                                                               |
|     |                                        | CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN |        |                   |                 |                       | VENDOR AS APPROVED BY      |                    |                   | DATE : 12/12/2015 |                                                                                                               |
|     |                                        | CONTRACT NO :                                 |        |                   |                 |                       |                            |                    |                   |                   |                                                                                                               |
| No. | Major Equipment                        | QP Inspection Category                        | QP No. | QP Submission SCH | QP Approval SCH | Proposed Sub Supplier | Country                    | SS Approval Status | SS Detail Sub.SCH | SS Approval SCH   | Remark                                                                                                        |
| 23  | Temperature Transmitter                | III                                           |        |                   |                 | EMERSON               | U.S.A/Pawane / Singapore   | A                  |                   |                   |                                                                                                               |
|     |                                        | III                                           |        |                   |                 | Yokogawa              | Japan                      | A                  |                   |                   | Final testing at M/S YIL, Bangalore is also acceptable                                                        |
|     |                                        | III                                           |        |                   |                 | Moore                 | USA                        | A                  |                   |                   |                                                                                                               |
|     |                                        | III                                           |        |                   |                 | M System              | JAPAN                      | A                  |                   |                   |                                                                                                               |
|     |                                        | III                                           |        |                   |                 | ABB                   | GERMANY/Faridabad          | A                  |                   |                   |                                                                                                               |
|     |                                        | III                                           |        |                   |                 | ENDRESS & HOUSER      | Aurangabad                 | A                  |                   |                   |                                                                                                               |
|     |                                        | *                                             |        |                   |                 | Khrone                |                            | DR                 |                   |                   | M/s BHEL will forward only two proposals after details review of BIFPCL Technical specification requirements. |
|     |                                        | *                                             |        |                   |                 | Tokyo Keiso           | Japan                      | DR                 |                   |                   |                                                                                                               |
|     |                                        | *                                             |        |                   |                 | INOR                  | Sweden                     | DR                 |                   |                   |                                                                                                               |
|     |                                        | *                                             |        |                   |                 | P & F                 | India                      | DR                 |                   |                   |                                                                                                               |
|     |                                        | *                                             |        |                   |                 | Siemens               |                            | DR                 |                   |                   |                                                                                                               |
|     |                                        | *                                             |        |                   |                 | Yamatake              | JAPAN                      | DR                 |                   |                   |                                                                                                               |
|     |                                        | *                                             |        |                   |                 | Yamari                | JAPAN                      | DR                 |                   |                   |                                                                                                               |
|     |                                        | *                                             |        |                   |                 | Foxboro               |                            | DR                 |                   |                   |                                                                                                               |
| 25  | Electronic transmitters (pressure, DP) | III                                           |        |                   |                 | EMERSON (Rosemount)   | USA/ Pawane                | A                  |                   |                   |                                                                                                               |
|     |                                        | III                                           |        |                   |                 | FUJI ELECTRIC         | China                      | A                  |                   |                   |                                                                                                               |
|     |                                        | III                                           |        |                   |                 | YOKOGAWA              | JAPAN                      | A                  |                   |                   | Testing and Calibration at M/s YIL, Bangalore is also acceptable.                                             |
|     |                                        | I                                             |        |                   |                 | ABB                   | FARIDABAD                  | A                  |                   |                   | Model - 2600 T                                                                                                |
|     |                                        | III                                           |        |                   |                 | ABB                   | GERMANY / Italy            | A                  |                   |                   | Model - 2600 T                                                                                                |
|     |                                        | III                                           |        |                   |                 | Siemens               | France / India             | A                  |                   |                   |                                                                                                               |
|     |                                        | III                                           |        |                   |                 | Honeywell             | Pune                       | A                  |                   |                   |                                                                                                               |
|     |                                        | *                                             |        |                   |                 | ENDRESS & HOUSER      | Aurangabad/ Germany        | DR                 |                   |                   |                                                                                                               |
| 26  | Thermocouples, RTD & Thermowell        | III                                           |        |                   |                 | HERAUS SENSOR         | GERMANY                    | A                  |                   |                   |                                                                                                               |
|     | Refer Note - 2                         | III                                           |        |                   |                 | WISE Control          | Korea                      | A                  |                   |                   |                                                                                                               |
|     |                                        | II                                            |        |                   |                 | Tempsens              | Udaipur                    | A                  |                   |                   |                                                                                                               |
|     |                                        | II                                            |        |                   |                 | Pyroelectric          | Goa                        | A                  |                   |                   |                                                                                                               |

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|  |                                   | PROJECT : Maitree STPP (2 x 660 MW)           |        |                   |                 | LIST OF ITEMS REQUIRING QP               |                     |                    | REF. NO :         |                 |                                                                                                               |
|-----------------------------------------------------------------------------------|-----------------------------------|-----------------------------------------------|--------|-------------------|-----------------|------------------------------------------|---------------------|--------------------|-------------------|-----------------|---------------------------------------------------------------------------------------------------------------|
|                                                                                   |                                   | PACKAGE : EPC PACKAGE                         |        |                   |                 | APPROVAL & ACCEPTABLE                    |                     |                    | REVISION NO : 00  |                 |                                                                                                               |
|                                                                                   |                                   | CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN |        |                   |                 | VENDOR AS APPROVED BY                    |                     |                    | DATE : 12/12/2015 |                 |                                                                                                               |
|                                                                                   |                                   | CONTRACT NO :                                 |        |                   |                 |                                          |                     |                    |                   |                 |                                                                                                               |
| No.                                                                               | Major Equipment                   | QP Inspection Category                        | QP No. | QP Submission SCH | QP Approval SCH | Proposed Sub Supplier                    | Country             | SS Approval Status | SS Detail Sub.SCH | SS Approval SCH | Remark                                                                                                        |
|                                                                                   |                                   | II                                            |        |                   |                 | Detriv Instrumentation & Electronics Ltd | Mumbai              | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | III                                           |        |                   |                 | Minco                                    | USA                 | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | III                                           |        |                   |                 | OKAZAKI corporation                      | JAPAN               | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | III                                           |        |                   |                 | Yamari                                   | JAPAN               | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | III                                           |        |                   |                 | Yamari                                   | Singapore           | A                  |                   |                 | For RTD Reference list and Performance feedback is to be submitted                                            |
|                                                                                   |                                   | III                                           |        |                   |                 | ABB(SENSYCON)                            | Germany             | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | III                                           |        |                   |                 | EMERSON (Rosemount)                      | Germany             | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | II                                            |        |                   |                 | EMERSON (Rosemount)                      | Pawane              | A                  |                   |                 | Imported from Emerson, Germany (make)                                                                         |
|                                                                                   |                                   | II                                            |        |                   |                 | Thermal Instruments(GIC)                 | Savantwadi          | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | II                                            |        |                   |                 | Techno Instruments                       | Ahamadabad          | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | *                                             |        |                   |                 | GOA Instrument Industries                | GOA                 | DR                 |                   |                 | M/s BHEL will forward only two proposals after details review of BIFPCL Technical specification requirements. |
|                                                                                   |                                   | *                                             |        |                   |                 | WIKA                                     | Pune                | DR                 |                   |                 |                                                                                                               |
|                                                                                   |                                   | *                                             |        |                   |                 | Toshniwai Industries                     | Ajmer               | DR                 |                   |                 |                                                                                                               |
|                                                                                   |                                   | *                                             |        |                   |                 | E & H                                    | Aurangabad          | DR                 |                   |                 |                                                                                                               |
|                                                                                   |                                   | *                                             |        |                   |                 | Baumer                                   | Vapi                | DR                 |                   |                 |                                                                                                               |
| 27                                                                                | Ultrasonic type level Transmitter | III                                           |        |                   |                 | E & H                                    | Aurangabad/ Germany | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | III                                           |        |                   |                 | EMERSON                                  | Pawane              | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | III                                           |        |                   |                 | SIEMENS MILTRONICS                       | CANADA              | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | *                                             |        |                   |                 | Wega                                     | Germany             | DR                 |                   |                 | M/s BHEL will forward only two proposals after details review of BIFPCL Technical specification requirements. |
|                                                                                   |                                   | *                                             |        |                   |                 | Khrone                                   | France / USA / Pune | DR                 |                   |                 |                                                                                                               |
|                                                                                   |                                   | *                                             |        |                   |                 | Yokogawa                                 | Bangalore           | DR                 |                   |                 |                                                                                                               |
|                                                                                   |                                   | *                                             |        |                   |                 | Honeywell                                | India               | DR                 |                   |                 |                                                                                                               |
|                                                                                   |                                   | *                                             |        |                   |                 | Magnetrol                                | Belgium             | DR                 |                   |                 |                                                                                                               |
|                                                                                   |                                   | *                                             |        |                   |                 | ABB                                      | Germany             | DR                 |                   |                 |                                                                                                               |
| 28                                                                                | Orifice plate assembly            | III                                           |        |                   |                 | Instrumentation Limited                  | Palghat             | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | III                                           |        |                   |                 | Microprecision                           | Faridabad           | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | III                                           |        |                   |                 | Starmech                                 | Pune                | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | III                                           |        |                   |                 | Flow Star                                | Faridabad           | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | III                                           |        |                   |                 | SEIKO                                    | Austria             | A                  |                   |                 |                                                                                                               |
|                                                                                   |                                   | III                                           |        |                   |                 | MINCO (GIC)                              | GOA                 | A                  |                   |                 |                                                                                                               |



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|  |                                      | PROJECT : Maitree STPP (2 x 660 MW)           |        |                   |                 |                                             | LIST OF ITEMS REQUIRING QP |                    |                   | REF. NO :         |                                                                                                               |
|-----------------------------------------------------------------------------------|--------------------------------------|-----------------------------------------------|--------|-------------------|-----------------|---------------------------------------------|----------------------------|--------------------|-------------------|-------------------|---------------------------------------------------------------------------------------------------------------|
|                                                                                   |                                      | PACKAGE : EPC PACKAGE                         |        |                   |                 |                                             | APPROVAL & ACCEPTABLE      |                    |                   | REVISION NO : 00  |                                                                                                               |
|                                                                                   |                                      | CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN |        |                   |                 |                                             | VENDOR AS APPROVED BY      |                    |                   | DATE : 12/12/2015 |                                                                                                               |
|                                                                                   |                                      | CONTRACT NO :                                 |        |                   |                 |                                             |                            |                    |                   |                   |                                                                                                               |
| No.                                                                               | Major Equipment                      | QP Inspection Category                        | QP No. | QP Submission SCH | QP Approval SCH | Proposed Sub Supplier                       | Country                    | SS Approval Status | SS Detail Sub.SCH | SS Approval SCH   | Remark                                                                                                        |
|                                                                                   |                                      | *                                             |        |                   |                 | HBL Power Systems                           | India                      | DR                 |                   |                   | M/s BHEL will forward only two proposals after details review of BIFPCL Technical specification requirements. |
|                                                                                   |                                      | *                                             |        |                   |                 | Dubas                                       | India                      | DR                 |                   |                   |                                                                                                               |
|                                                                                   |                                      | *                                             |        |                   |                 | Chloride Power Systems (caldyne)            | India                      | DR                 |                   |                   |                                                                                                               |
|                                                                                   |                                      | *                                             |        |                   |                 | Universal Instrument manufacturing co P Ltd | India                      | DR                 |                   |                   |                                                                                                               |
|                                                                                   |                                      | *                                             |        |                   |                 | Hind Rectifier Ltd                          | India                      | DR                 |                   |                   |                                                                                                               |
| 38                                                                                | Battery Health Monitoring System     | III                                           |        |                   |                 | Emerson                                     | Mumbai                     | A                  |                   |                   |                                                                                                               |
|                                                                                   |                                      | III                                           |        |                   |                 | Eltek SGS Pvt Ltd                           | Gurgaon                    | A                  |                   |                   |                                                                                                               |
|                                                                                   |                                      | *                                             |        |                   |                 | B Tech Inc                                  | USA                        | DR                 |                   |                   |                                                                                                               |
|                                                                                   |                                      | *                                             |        |                   |                 | Hitachi Hi Rel                              | Gandhinagar                | DR                 |                   |                   |                                                                                                               |
|                                                                                   |                                      | *                                             |        |                   |                 | Hopeckee                                    | Germany                    | DR                 |                   |                   |                                                                                                               |
| 39                                                                                | Battery(Ni-cd)                       | I                                             |        |                   |                 | AMCO SAFT                                   | Bangalore                  | A                  |                   |                   |                                                                                                               |
|                                                                                   |                                      | II                                            |        |                   |                 | SAFT                                        | France/Sweede              | A                  |                   |                   |                                                                                                               |
|                                                                                   |                                      | I                                             |        |                   |                 | HBL POWER                                   | Hyderabad                  | A                  |                   |                   |                                                                                                               |
|                                                                                   |                                      | *                                             |        |                   |                 | Hopeckee                                    | Germany                    | DR                 |                   |                   |                                                                                                               |
| 40                                                                                | Battery (Lead Acid Tubular / Plante) | I                                             |        |                   |                 | Exide                                       | Kolkata                    | A                  |                   |                   |                                                                                                               |
|                                                                                   |                                      | I                                             |        |                   |                 | HBL POWER                                   | Hyderabad                  | DR                 |                   |                   | Only for tubular                                                                                              |
|                                                                                   |                                      | I                                             |        |                   |                 | Hopeckee                                    | Germany                    | DR                 |                   |                   |                                                                                                               |
| 41                                                                                | Impulse pipe & tubes                 | II                                            |        |                   |                 | Maharashtra Seamless                        | Raigarh                    | A                  |                   |                   | Carbon steel only                                                                                             |
|                                                                                   |                                      | II                                            |        |                   |                 | Sumitomo/kawasaki/Nippon                    | Japan                      | A                  |                   |                   |                                                                                                               |
|                                                                                   |                                      | II                                            |        |                   |                 | TPS TECHNITUBE                              | Germany                    | A                  |                   |                   |                                                                                                               |
|                                                                                   |                                      | II                                            |        |                   |                 | Veluric & manessmann                        | Germany                    | A                  |                   |                   |                                                                                                               |
|                                                                                   |                                      | II                                            |        |                   |                 | BHEL                                        | Trichy                     | A                  |                   |                   |                                                                                                               |
|                                                                                   |                                      | II                                            |        |                   |                 | Trouvay and Cauvin                          | France                     | A                  |                   |                   | Makes shall be as per approved list (Sr. No. 41)                                                              |
|                                                                                   |                                      | II                                            |        |                   |                 | ISMT                                        | Ahamadnagar                | A                  |                   |                   | Carbon steel only.                                                                                            |
|                                                                                   |                                      | II                                            |        |                   |                 | Sandvik                                     |                            | A                  |                   |                   | For SS only.                                                                                                  |
|                                                                                   |                                      | *                                             |        |                   |                 | Jindal saw                                  | India                      | DR                 |                   |                   |                                                                                                               |
|                                                                                   |                                      | *                                             |        |                   |                 | Ratanamani Metal and                        | Ahamadabad                 | DR                 |                   |                   |                                                                                                               |
|                                                                                   |                                      | *                                             |        |                   |                 | Shubhalaxmi Metal and                       | Mumbai                     | DR                 |                   |                   |                                                                                                               |
| 45                                                                                | Local Instrument Enclosure/Rack      | I                                             |        |                   |                 | Pyrotech                                    | Udaipur                    | A                  |                   |                   |                                                                                                               |
|                                                                                   |                                      | I                                             |        |                   |                 | Instrumentation Limited                     | Kota                       | A                  |                   |                   |                                                                                                               |

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|-----------------------------------------------------------------------------------|---------------------|-----------------------------------------------|--------|-------------------|-----------------|-----------------------|----------------------------|--------------------|-------------------|-------------------|----------------------------------------------------------------------------------------------------------|
|  |                     | PROJECT : Maitree STPP (2 x 660 MW)           |        |                   |                 |                       | LIST OF ITEMS REQUIRING QP |                    |                   | REF. NO :         |                                                                                                          |
|                                                                                   |                     | PACKAGE : EPC PACKAGE                         |        |                   |                 |                       | APPROVAL & ACCEPTABLE      |                    |                   | REVISION NO : 00  |                                                                                                          |
|                                                                                   |                     | CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN |        |                   |                 |                       | VENDOR AS APPROVED BY      |                    |                   | DATE : 12/12/2015 |                                                                                                          |
|                                                                                   |                     | CONTRACT NO :                                 |        |                   |                 |                       |                            |                    |                   |                   |                                                                                                          |
| No.                                                                               | Major Equipment     | QP Inspection Category                        | QP No. | QP Submission SCH | QP Approval SCH | Proposed Sub Supplier | Country                    | SS Approval Status | SS Detail Sub.SCH | SS Approval SCH   | Remark                                                                                                   |
|                                                                                   |                     | I                                             |        |                   |                 | Sajas electrical      | Trichurapalli              | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | I                                             |        |                   |                 | Prammen               | Puddukottai                | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | I                                             |        |                   |                 | Chemin                | Pondicherry                | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | *                                             |        |                   |                 | Forbes Marshall       | Pune                       | DR                 |                   |                   |                                                                                                          |
|                                                                                   |                     | *                                             |        |                   |                 | Procon                | Chennai                    | DR                 |                   |                   |                                                                                                          |
| 46                                                                                | Instrument Cables   | II                                            |        |                   |                 | Paramount             | Khushkhera                 | A                  |                   |                   | PVC,FRLS type,RQP                                                                                        |
|                                                                                   |                     | II                                            |        |                   |                 | Polycab               | Daman                      | A                  |                   |                   | PVC,FRLS type,RQP                                                                                        |
|                                                                                   |                     | II                                            |        |                   |                 | Delton                | Faridabad                  | A                  |                   |                   | PVC,FRLS type,RQP                                                                                        |
|                                                                                   |                     | II                                            |        |                   |                 | KEI                   | Bhiwadi                    | A                  |                   |                   | PVC,FRLS type                                                                                            |
|                                                                                   |                     | II                                            |        |                   |                 | Elkey Telelinks       | Faridabad                  | A                  |                   |                   | PVC,FRLS type                                                                                            |
|                                                                                   |                     | II                                            |        |                   |                 | CORDS                 | Bhiwadi                    | A                  |                   |                   | PVC,FRLS type,RQP                                                                                        |
|                                                                                   |                     | II                                            |        |                   |                 | CORDS                 | Kaharani                   | A                  |                   |                   | PVC,FRLS type,RQP                                                                                        |
|                                                                                   |                     | II                                            |        |                   |                 | Nicco                 | Kolkata                    | A                  |                   |                   | PVC,FRLS type                                                                                            |
|                                                                                   |                     | II                                            |        |                   |                 | TEW & C               | USA                        | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | II                                            |        |                   |                 | Habia cables          | Sweedan                    | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | II                                            |        |                   |                 | Kerpen cables         | Germany                    | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | II                                            |        |                   |                 | Lapp cables           | Germany                    | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | II                                            |        |                   |                 | Thermo electra Bv     | Netherland                 | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | II                                            |        |                   |                 | Universal Cable       | Satna                      | A                  |                   |                   | PVC,FRLS type                                                                                            |
|                                                                                   |                     | II                                            |        |                   |                 | Thermocables          | Hyderabad                  | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | II                                            |        |                   |                 | Finolex Cable         | Pune                       | DR *               |                   |                   |                                                                                                          |
|                                                                                   |                     | II                                            |        |                   |                 | Incab                 | Pune                       | DR *               |                   |                   |                                                                                                          |
|                                                                                   |                     | *                                             |        |                   |                 | Lapp cables           | India                      | DR                 |                   |                   | BHEL will forward only two proposals after details review of BIFPCL Technical specification requirements |
|                                                                                   |                     | *                                             |        |                   |                 | Lioni cable           | Pune                       | DR                 |                   |                   |                                                                                                          |
|                                                                                   |                     | *                                             |        |                   |                 | Gupta Cable           | Orisa                      | DR                 |                   |                   |                                                                                                          |
|                                                                                   |                     | *                                             |        |                   |                 | CMI                   | Faridabad                  | DR                 |                   |                   |                                                                                                          |
| 47                                                                                | Electrical actuator | III                                           |        |                   |                 | Auma                  | Germany                    | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | III                                           |        |                   |                 | Limitorge             | USA                        | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | III                                           |        |                   |                 | Rotorg                | UK                         | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | II                                            |        |                   |                 | Limitorque            | Faridabad                  | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | II                                            |        |                   |                 | Rotork                | Chennai/<br>Bangalore      | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | III                                           |        |                   |                 | Nippon gear           | Japan                      | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | II                                            |        |                   |                 | Auma                  | Bangalore                  | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | III                                           |        |                   |                 | Harold Beck           | USA                        | A                  |                   |                   |                                                                                                          |
|                                                                                   |                     | III                                           |        |                   |                 | Drehmo                | Germany                    | A                  |                   |                   |                                                                                                          |

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|                                                                                   |                                                 |                                               |        |                   |                 |                                |             |                    |                   |                 |                              |
|-----------------------------------------------------------------------------------|-------------------------------------------------|-----------------------------------------------|--------|-------------------|-----------------|--------------------------------|-------------|--------------------|-------------------|-----------------|------------------------------|
|  |                                                 | PROJECT : Maitree STPP (2 x 660 MW)           |        |                   |                 | LIST OF ITEMS REQUIRING QP     |             |                    | REF. NO :         |                 |                              |
|                                                                                   |                                                 | PACKAGE : EPC PACKAGE                         |        |                   |                 | APPROVAL & ACCEPTABLE          |             |                    | REVISION NO : 00  |                 |                              |
|                                                                                   |                                                 | CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN |        |                   |                 | VENDOR AS APPROVED BY          |             |                    | DATE : 12/12/2015 |                 |                              |
|                                                                                   |                                                 | CONTRACT NO :                                 |        |                   |                 |                                |             |                    |                   |                 |                              |
| No.                                                                               | Major Equipment                                 | QP Inspection Category                        | QP No. | QP Submission SCH | QP Approval SCH | Proposed Sub Supplier          | Country     | SS Approval Status | SS Detail Sub.SCH | SS Approval SCH | Remark                       |
|                                                                                   |                                                 | *                                             |        |                   |                 | Uniflex Cables                 | India       | DR                 |                   |                 |                              |
| 51                                                                                | Pneumatic Actuator<br>(Power Cylinder e. g. FOR | II                                            |        |                   |                 | Dong Woo Valve Control Co. LTD | Korea       | A                  |                   |                 |                              |
|                                                                                   |                                                 | II                                            |        |                   |                 | Shin Hwa Engineering Co. LTD   | Korea       | A                  |                   |                 |                              |
|                                                                                   |                                                 | I                                             |        |                   |                 | Instrumentation Limited        | Palghat     | A                  |                   |                 |                              |
|                                                                                   |                                                 | I                                             |        |                   |                 | Kelton                         |             | A                  |                   |                 |                              |
|                                                                                   |                                                 | I                                             |        |                   |                 | SMC Pneumatics                 | Noida       | A                  |                   |                 | Up to 12 inch only           |
|                                                                                   |                                                 | I                                             |        |                   |                 | Rotex                          | Mumbai      | A                  |                   |                 | Conditional                  |
|                                                                                   |                                                 | *                                             |        |                   |                 | Festo                          | Bangalore   | DR                 |                   |                 |                              |
| 53                                                                                | Transducer                                      | II                                            |        |                   |                 | AE                             | Mumbai      | A                  |                   |                 |                              |
|                                                                                   |                                                 | II                                            |        |                   |                 | Southern Transducer            | Chennai     | A                  |                   |                 |                              |
|                                                                                   |                                                 | II                                            |        |                   |                 | Elster                         | Mumbai      | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | Camilie Bauer                  | Germany     | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | Metrawat                       | Germany     | A                  |                   |                 |                              |
|                                                                                   |                                                 | II                                            |        |                   |                 | Rishab                         | Nasik       | A                  |                   |                 |                              |
|                                                                                   |                                                 | *                                             |        |                   |                 | Pyrotech                       | Udaipur     | DR                 |                   |                 |                              |
| 59                                                                                | Coupling / Interposing relays                   | III                                           |        |                   |                 | PARAMOUNT                      | BANGALORE   | A                  |                   |                 | * To be covered in DDCMIS QP |
|                                                                                   |                                                 | III                                           |        |                   |                 | OMRON                          |             | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | OEN                            |             | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | Jyoti                          | Baroda      | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | ELSTA                          | SWITZERLAN  | A                  |                   |                 |                              |
|                                                                                   |                                                 | *                                             |        |                   |                 | Schneider                      | Germany     | DR                 |                   |                 |                              |
|                                                                                   |                                                 | *                                             |        |                   |                 | Siemens                        | Germany     | DR                 |                   |                 |                              |
|                                                                                   |                                                 | *                                             |        |                   |                 | Phoenix                        | Germany     | DR                 |                   |                 |                              |
| 60                                                                                | Solenoid valve                                  | III                                           |        |                   |                 | Rotex                          | Vadodara    | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | Avcon                          | Mumabi      | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | Herion                         | Germany     | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | IMI NORGEN                     | GERMANY     | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | Jafferson                      | Argentina   | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | Asco                           | Chennai/USA | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | Festo                          | Bangalore   | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | SMC                            | Noida       | A                  |                   |                 |                              |
|                                                                                   |                                                 | III                                           |        |                   |                 | Parker                         | Brand Name  | A                  |                   |                 |                              |
|                                                                                   |                                                 | *                                             |        |                   |                 | Schneider                      | Germany     |                    |                   |                 |                              |

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|  |                                          | PROJECT : Maitree STPP (2 x 660 MW)           |        |                   |                 | LIST OF ITEMS REQUIRING QP                                          |                     |                    | REF. NO :         |                 |                               |
|-----------------------------------------------------------------------------------|------------------------------------------|-----------------------------------------------|--------|-------------------|-----------------|---------------------------------------------------------------------|---------------------|--------------------|-------------------|-----------------|-------------------------------|
|                                                                                   |                                          | PACKAGE : EPC PACKAGE                         |        |                   |                 | APPROVAL & ACCEPTABLE                                               |                     |                    | REVISION NO : 00  |                 |                               |
|                                                                                   |                                          | CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN |        |                   |                 | VENDOR AS APPROVED BY                                               |                     |                    | DATE : 12/12/2015 |                 |                               |
|                                                                                   |                                          | CONTRACT NO :                                 |        |                   |                 |                                                                     |                     |                    |                   |                 |                               |
| No.                                                                               | Major Equipment                          | QP Inspection Category                        | QP No. | QP Submission SCH | QP Approval SCH | Proposed Sub Supplier                                               | Country             | SS Approval Status | SS Detail Sub.SCH | SS Approval SCH | Remark                        |
|                                                                                   |                                          | *                                             |        |                   |                 | Neucon Industries Pvt. Ltd.                                         |                     | DR                 |                   |                 |                               |
| 61                                                                                | Lube oil control valve - Self Regulating | II                                            |        |                   |                 | NUOVO PIGNONE                                                       | ITALY               | A                  |                   |                 |                               |
|                                                                                   |                                          | II                                            |        |                   |                 | EMERSON                                                             | CHENNAI             | A                  |                   |                 |                               |
|                                                                                   |                                          | II                                            |        |                   |                 | SAMSON                                                              | GERMANY / PUNE      | A                  |                   |                 |                               |
|                                                                                   |                                          | II                                            |        |                   |                 | Forbes Arca                                                         | Pune                | A                  |                   |                 | Approved up to 4", 150 Class. |
| 62                                                                                | Guided wave Radar type level transmitter | III                                           |        |                   |                 | Magnetrol                                                           | Belgium             | A                  |                   |                 |                               |
|                                                                                   |                                          | III                                           |        |                   |                 | Endress & Houser                                                    | Germany/ Aurangabad | A                  |                   |                 |                               |
|                                                                                   |                                          | III                                           |        |                   |                 | Emerson                                                             | Sweden/ PAWANE      | A                  |                   |                 |                               |
|                                                                                   |                                          | III                                           |        |                   |                 | ABB(K-Tech)                                                         | USA                 | A                  |                   |                 |                               |
|                                                                                   |                                          | *                                             |        |                   |                 | Yokogawa                                                            | Japan               | DR                 |                   |                 |                               |
|                                                                                   |                                          | *                                             |        |                   |                 | Khrone                                                              | France              | DR                 |                   |                 |                               |
|                                                                                   |                                          | *                                             |        |                   |                 | HONEYWELL                                                           |                     | DR                 |                   |                 |                               |
|                                                                                   |                                          | *                                             |        |                   |                 | Siemens                                                             | India               | DR                 |                   |                 |                               |
| 63                                                                                | Maintenance and Calibration Equipment    |                                               |        |                   |                 | Main Contractor will propose the vendors during detail Engineering. |                     |                    |                   |                 |                               |
| 65                                                                                | Furniture for computer                   | III                                           |        |                   |                 | OTS office tech.                                                    | India               | NOTE               |                   |                 |                               |
|                                                                                   |                                          | III                                           |        |                   |                 | Godrej boyce                                                        |                     | NOTE               |                   |                 |                               |
|                                                                                   |                                          | III                                           |        |                   |                 | Fetherlite                                                          |                     | NOTE               |                   |                 |                               |
|                                                                                   |                                          | III                                           |        |                   |                 | PAN Office                                                          |                     | NOTE               |                   |                 |                               |
|                                                                                   |                                          | III                                           |        |                   |                 | Pyrotech                                                            |                     | NOTE               |                   |                 |                               |
| 66                                                                                | Terminal Block (Cage and Clamp type)     | III                                           |        |                   |                 | Weidmuller                                                          | Germany             | A                  |                   |                 |                               |
|                                                                                   |                                          | III                                           |        |                   |                 | Phoenix                                                             | Germany /           | A                  |                   |                 |                               |
|                                                                                   |                                          | III                                           |        |                   |                 | Wago                                                                | Germany /           | A                  |                   |                 |                               |
|                                                                                   |                                          | III                                           |        |                   |                 | Elmex                                                               | Vadodara            | A                  |                   |                 | CE Mark only                  |

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|  |                                                       | PROJECT : Maitree STPP (2 x 660 MW)           |        |                   |                 | LIST OF ITEMS REQUIRING QP         |              |                    | REF. NO :         |                 |                                                       |
|-----------------------------------------------------------------------------------|-------------------------------------------------------|-----------------------------------------------|--------|-------------------|-----------------|------------------------------------|--------------|--------------------|-------------------|-----------------|-------------------------------------------------------|
|                                                                                   |                                                       | PACKAGE : EPC PACKAGE                         |        |                   |                 | APPROVAL & ACCEPTABLE              |              |                    | REVISION NO : 00  |                 |                                                       |
|                                                                                   |                                                       | CONTRACTOR : BHEL - PEM, HYD, Trichy, PC, EDN |        |                   |                 | VENDOR AS APPROVED BY              |              |                    | DATE : 12/12/2015 |                 |                                                       |
|                                                                                   |                                                       | CONTRACT NO :                                 |        |                   |                 |                                    |              |                    |                   |                 |                                                       |
| No.                                                                               | Major Equipment                                       | QP Inspection Category                        | QP No. | QP Submission SCH | QP Approval SCH | Proposed Sub Supplier              | Country      | SS Approval Status | SS Detail Sub.SCH | SS Approval SCH | Remark                                                |
|                                                                                   |                                                       | I                                             |        |                   |                 | Cosmos                             | Noida        | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | I                                             |        |                   |                 | Adarsh Control                     | Bangalore    | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | *                                             |        |                   |                 | Chemin Controls                    | Pondichery   | DR                 |                   |                 |                                                       |
|                                                                                   |                                                       | *                                             |        |                   |                 | Harmony Systems                    | New Delhi    | DR                 |                   |                 |                                                       |
| 83                                                                                | Digital Indicators                                    | III                                           |        |                   |                 | Masibus                            | Gandhi Nagar | A                  |                   |                 | For Non mosaic mounting                               |
|                                                                                   |                                                       | III                                           |        |                   |                 | ABB                                | Germany      | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Foxboro                            | UK           | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Yokogawa                           | Japan        | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Gossen / Metrowatt / Camille Bauer | Germany      | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Siemens                            | Germany      | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Chino                              | Japan        | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Weigell Messgerate                 | Germany      | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Pyrotech                           | Udaipur      | A                  |                   |                 | For Non mosaic mounting                               |
|                                                                                   |                                                       | *                                             |        |                   |                 | Chino Corporation                  | Mumbai       | DR                 |                   |                 |                                                       |
|                                                                                   |                                                       | *                                             |        |                   |                 | Yokogawa                           | Bangalore    | DR                 |                   |                 | For Non mosaic mounting and submit only two proposals |
|                                                                                   |                                                       | *                                             |        |                   |                 | Lektrotek                          | Pune         | DR                 |                   |                 |                                                       |
|                                                                                   |                                                       | *                                             |        |                   |                 | Teleterm                           | Chennai      | DR                 |                   |                 |                                                       |
| 84                                                                                | Dust Emission Monitor                                 | III                                           |        |                   |                 | Land Combustion                    | UK           | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Durag                              | Germany      | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Sick Maihak                        | Germany      | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Emerson Process Management         | Ireland      | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Codel                              | UK           | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | II                                            |        |                   |                 | Forbes Marshall                    | Pune         | A                  |                   |                 | maint kit from M/S Codel, UK                          |
| 85                                                                                | Electrical Indicating Instruments (Mosaic Compatible) | III                                           |        |                   |                 | Siemens                            | Germany      | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Gossen / Metrowatt / Camille Bauer | Germany      | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Ganz                               | Germany      | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Weigell Messgerate                 | Germany      | A                  |                   |                 |                                                       |
| 86                                                                                | Flue Gas Analyser (CO)                                | III                                           |        |                   |                 | Codel                              | UK           | A                  |                   |                 |                                                       |
|                                                                                   |                                                       | III                                           |        |                   |                 | Emerson Process Management         | Pawane       | A                  |                   |                 | Analysers from M/s Emerson, Germany / USA.            |
|                                                                                   |                                                       | III                                           |        |                   |                 | Land Combustion                    | UK           | A                  |                   |                 |                                                       |

Pradeep A

Khanchi

34 276 III

**SUB-VENDOR LIST FOR C&I**  
**2X660 MW MAITREE STPP- BANGLADESH**

| SI No | Package Code | Package Name                          | Supplier Name                                      | Tech Limit                                                                                                                                   |
|-------|--------------|---------------------------------------|----------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------|
| 1     | 145-04000-A  | CONTROL VALVE                         | FORBES MARSHALL ARCA PVT.LTD.                      | No technical limit exists except for feed control valve. For feed control valves, approved up to sub-critical power plants of 600 MW rating. |
| 2     | 145-04000-A  | CONTROL VALVE                         | INSTRUMENTATION LTD.                               |                                                                                                                                              |
| 3     | 145-04000-A  | CONTROL VALVE                         | Koso India Private Limited,                        |                                                                                                                                              |
| 4     | 145-04000-A  | CONTROL VALVE                         | BOMAFI SPECIAL VALVE SOLUTIONS PVT LTD             |                                                                                                                                              |
| 5     | 145-04000-A  | CONTROL VALVE                         | KSB MIL CONTROLS LTD.                              |                                                                                                                                              |
| 6     | 145-04000-A  | CONTROL VALVE                         | SUZHOU DELAN ENERGY SCIENCE & TECHNOLOGY CO., LTD. |                                                                                                                                              |
| 7     | 145-04000-A  | CONTROL VALVE                         | WALDEMAR PRUSS ARMATURENFABRIK GMBH                |                                                                                                                                              |
| 8     | 145-04000-A  | CONTROL VALVE                         | Mascot Valves Pvt. Ltd.                            |                                                                                                                                              |
| 9     | 145-04000-A  | CONTROL VALVE                         | R.K.CONTROL INSTRUMENTS PVT. LTD.                  | For subcritical power plant up to 150MW                                                                                                      |
| 10    | 145-04000-A  | CONTROL VALVE                         | Valitalia S.P.A. ,                                 |                                                                                                                                              |
| 11    | 145-04000-A  | CONTROL VALVE                         | PARCOL S.p.A                                       |                                                                                                                                              |
| 12    | 145-04000-A  | CONTROL VALVE                         | EMERSON PROCESS MANAGEMENT CHENNAI LIMITED         |                                                                                                                                              |
| 13    | 145-04000-A  | CONTROL VALVE                         | DRESSER VALVE INDIA PVT. LTD                       |                                                                                                                                              |
| 14    | 145-06000-A  | PRESSURE SWITCH/DIFF. PRESSURE SWITCH | DRESSER INDUSTRIES INC.                            |                                                                                                                                              |
| 15    | 145-06000-A  | PRESSURE SWITCH/DIFF. PRESSURE SWITCH | Barksdale GmbH, Germany                            |                                                                                                                                              |
| 16    | 145-06000-A  | PRESSURE SWITCH/DIFF. PRESSURE SWITCH | SWITZER PROCESS INSTRUMENTS PVT. LTD.              |                                                                                                                                              |
| 17    | 145-06000-A  | PRESSURE SWITCH/DIFF. PRESSURE SWITCH | PRECISION MASS PRODUCTS PVT. LTD.                  |                                                                                                                                              |
| 18    | 145-06000-A  | PRESSURE SWITCH/DIFF. PRESSURE SWITCH | INDFOS INDUSTRIES LIMITED                          |                                                                                                                                              |
| 19    | 145-06000-A  | PRESSURE SWITCH/DIFF. PRESSURE SWITCH | GENERAL INSTRUMENTS CONSORTIUM                     |                                                                                                                                              |
| 20    | 145-06000-A  | PRESSURE SWITCH/DIFF. PRESSURE SWITCH | SOR INC.                                           |                                                                                                                                              |
| 21    | 145-06000-A  | PRESSURE SWITCH/DIFF. PRESSURE SWITCH | INDFOS (INDIA) LIMITED                             |                                                                                                                                              |
| 22    | 145-06000-A  | PRESSURE SWITCH/DIFF. PRESSURE SWITCH | Kaustubha Udyog,                                   |                                                                                                                                              |
| 23    | 145-08000-A  | PRESSURE GAUGE/ DIFF.PRESSURE GAUGE   | H.GURU INDUSTRIES                                  |                                                                                                                                              |
| 24    | 145-08000-A  | PRESSURE GAUGE/ DIFF.PRESSURE GAUGE   | BOSE PANDA INSTRUMENTS PVT.LTD.                    |                                                                                                                                              |
| 25    | 145-08000-A  | PRESSURE GAUGE/ DIFF.PRESSURE GAUGE   | A.N. INSTRUMENTS PVT. LTD.                         |                                                                                                                                              |
| 26    | 145-08000-A  | PRESSURE GAUGE/ DIFF.PRESSURE GAUGE   | PRECISION MASS PRODUCTS PVT. LTD.                  |                                                                                                                                              |
| 27    | 145-08000-A  | PRESSURE GAUGE/ DIFF.PRESSURE GAUGE   | Baumer Technologies India Pvt. Ltd.                |                                                                                                                                              |
| 28    | 145-08000-A  | PRESSURE GAUGE/ DIFF.PRESSURE GAUGE   | H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD            |                                                                                                                                              |
| 29    | 145-08000-A  | PRESSURE GAUGE/ DIFF.PRESSURE GAUGE   | FORBES MARSHALL (HYD) LTD.                         |                                                                                                                                              |

|    |             |                                     |                                            |                    |
|----|-------------|-------------------------------------|--------------------------------------------|--------------------|
| 30 | 145-08000-A | PRESSURE GAUGE/ DIFF.PRESSURE GAUGE | GAUGE BOURDON INDIA PVT. LTD.              |                    |
| 31 | 145-08000-A | PRESSURE GAUGE/ DIFF.PRESSURE GAUGE | SCIENTIFIC DEVICES (BOMBAY) PVT LTD,       |                    |
| 32 | 145-08000-A | PRESSURE GAUGE/ DIFF.PRESSURE GAUGE | Nesstech Instruments Private Limited       |                    |
| 33 | 145-10000-A | TEMPERATURE GAUGE                   | FORBES MARSHALL (HYD) LTD.                 |                    |
| 34 | 145-10000-A | TEMPERATURE GAUGE                   | GOA INSTRUMENTS INDUSTRIES PVT.LTD.,       |                    |
| 35 | 145-10000-A | TEMPERATURE GAUGE                   | H.GURU INSTRUMENTS (SOUTH INDIA) P. LTD    |                    |
| 36 | 145-10000-A | TEMPERATURE GAUGE                   | GAUGE BOURDON INDIA PVT. LTD.              |                    |
| 37 | 145-10000-A | TEMPERATURE GAUGE                   | H.GURU INDUSTRIES                          |                    |
| 38 | 145-10000-A | TEMPERATURE GAUGE                   | GOA THERMOSTATIC INSTRUMENTS PVT.LTD.      |                    |
| 39 | 145-10000-A | TEMPERATURE GAUGE                   | A.N. INSTRUMENTS PVT. LTD.                 |                    |
| 40 | 145-10000-A | TEMPERATURE GAUGE                   | Baumer Technologies India Pvt. Ltd.        |                    |
| 41 | 145-10000-A | TEMPERATURE GAUGE                   | PRECISION MASS PRODUCTS PVT. LTD.          |                    |
| 42 | 145-11000-A | LEVEL GAUGE                         | BLISS ANAND PVT. LTD.                      |                    |
| 43 | 145-11000-A | LEVEL GAUGE                         | TOSHNIWAL BROTHERS PVT.LTD.                | MAKE:NIVO CONTROLS |
| 44 | 145-11000-A | LEVEL GAUGE                         | SIGMA INSTRUMENTS CO.                      |                    |
| 45 | 145-12000-A | FLOW ELEMENT                        | MICRO PRECISION PRODUCTS PVT. LTD.         |                    |
| 46 | 145-12000-A | FLOW ELEMENT                        | TM TECNOMATIC SPA                          |                    |
| 47 | 145-12000-A | FLOW ELEMENT                        | STAR-MECH CONTROLS (I) PVT.LTD.            |                    |
| 48 | 145-12000-A | FLOW ELEMENT                        | INSTRUMENTATION LTD.                       |                    |
| 49 | 145-13000-A | TEMP. ELEMENT                       | DETRIVE INSTRUMENTATION & ELECTRONICS LTD. |                    |
| 50 | 145-13000-A | TEMP. ELEMENT                       | Thermal Instrument India Pvt. Ltd.         |                    |
| 51 | 145-13000-A | TEMP. ELEMENT                       | Tempsens Instrument (I) Pvt Ltd            |                    |
| 52 | 145-13000-A | TEMP. ELEMENT                       | PYRO ELECTRIC INSTRUMENTS GOA PVT.LTD.     |                    |
| 53 | 145-13000-A | TEMP. ELEMENT                       | TECHNO INSTRUMENTS                         |                    |
| 54 | 145-13000-A | TEMP. ELEMENT                       | Baumer Technologies India Pvt. Ltd.        |                    |
| 55 | 145-13000-A | TEMP. ELEMENT                       | TM TECNOMATIC SPA                          |                    |
| 56 | 145-13000-A | TEMP. ELEMENT                       | TOSHNIWAL INDUSTRIES PVT. LTD.,            |                    |
| 57 | 145-13000-A | TEMP. ELEMENT                       | GOA INSTRUMENTS INDUSTRIES PVT.LTD.,       |                    |
| 58 | 145-13000-A | TEMP. ELEMENT                       | GAUGE BOURDON INDIA PVT. LTD.              |                    |
| 59 | 145-13000-A | TEMP. ELEMENT                       | Nesstech Instruments Private Limited       |                    |

|    |             |                               |                                             |                                                                  |
|----|-------------|-------------------------------|---------------------------------------------|------------------------------------------------------------------|
| 60 | 145-13000-A | TEMP. ELEMENT                 | SCIENTIFIC DEVICES (BOMBAY) PVT LTD,        |                                                                  |
| 61 | 145-14000-A | TRANSMITTERS                  | ABB LIMITED                                 | PRESSURE TRANSMITTER, DP TRANSMITTER and TEMP TRANSMITTER        |
| 62 | 145-14000-A | TRANSMITTERS                  | Pune Techtrol Pvt. Ltd.                     | Only for capacitance Type Level Transmitter                      |
| 63 | 145-14000-A | TRANSMITTERS                  | V. AUTOMAT & INSTRUMENTS (P) LTD.           | a)DISPLACEMENT TYPE TRANSMITTERS. b)PRESSURE AND DP TRANSMITTERS |
| 64 | 145-14000-A | TRANSMITTERS                  | Moore Industries International Inc.         |                                                                  |
| 65 | 145-14000-A | TRANSMITTERS                  | PANAM ENGINEERS                             | For Pressure and Diff. Pressure transmitter                      |
| 66 | 145-14000-A | TRANSMITTERS                  | TOSHNIWAL INDUSTRIES PVT. LTD.,             |                                                                  |
| 67 | 145-14000-A | TRANSMITTERS                  | Endress + Hauser (India) Pvt. Ltd.,         |                                                                  |
| 68 | 145-14000-A | TRANSMITTERS                  | YOKOGAWA INDIA LIMITED,                     |                                                                  |
| 69 | 145-14000-A | TRANSMITTERS                  | SBEM PVT. LTD.                              | FOR CAPACITANCE TYPE.                                            |
| 70 | 145-14000-A | TRANSMITTERS                  | SIEMENS LIMITED                             |                                                                  |
| 71 | 145-14000-A | TRANSMITTERS                  | EMERSON PROCESS MANAGEMENT (INDIA) PVT.LTD. |                                                                  |
| 72 | 145-14000-A | TRANSMITTERS                  | SMART INSTRUMENTS LTD, BRAZIL               | LD-301 & T-301 TRANSMITTER FROM M/S SMART EQUIPMENTS BRAZIL.     |
| 73 | 145-14000-A | TRANSMITTERS                  | NIVO CONTROLS PVT. LTD.                     | For Capacitance type only                                        |
| 74 | 145-14000-A | TRANSMITTERS                  | Honeywell Automation India Limited          |                                                                  |
| 75 | 145-25000-A | JUNCTION BOX                  | Shrenik & Company,                          |                                                                  |
| 76 | 145-25000-A | JUNCTION BOX                  | SUCHITRA INDUSTRIES                         |                                                                  |
| 77 | 145-25000-A | JUNCTION BOX                  | FLEXPRO ELECTRICALS PVT. LTD.               | Metal type junction box only                                     |
| 78 | 145-25000-A | JUNCTION BOX                  | K.S.INSTRUMENTS PVT.LTD.                    |                                                                  |
| 79 | 145-25000-A | JUNCTION BOX                  | AJMERA INDUSTRIAL & ENGINEERING WORKS       |                                                                  |
| 80 | 145-32000-A | INSTRUMENTS TUBE FITTINGS     | VIKAS INDUSTRIAL PRODUCTS                   |                                                                  |
| 81 | 145-32000-A | INSTRUMENTS TUBE FITTINGS     | Fluid Controls Pvt. Ltd.                    |                                                                  |
| 82 | 145-32000-A | INSTRUMENTS TUBE FITTINGS     | AURA INCORPORATED                           |                                                                  |
| 83 | 145-32000-A | INSTRUMENTS TUBE FITTINGS     | PRECISION ENGINEERING INDUSTRIES            |                                                                  |
| 84 | 145-35000-A | LEVEL SWITCH-CAPACITANCE TYPE | SIGMA INSTRUMENTS CO.                       |                                                                  |
| 85 | 145-35000-A | LEVEL SWITCH-CAPACITANCE TYPE | Sapcon Instrument Pvt Ltd.                  |                                                                  |
| 86 | 145-35000-A | LEVEL SWITCH-CAPACITANCE TYPE | V. AUTOMAT & INSTRUMENTS (P) LTD.           |                                                                  |
| 87 | 145-35000-A | LEVEL SWITCH-CAPACITANCE TYPE | SCIENTIFIC DEVICES (BOMBAY) PVT LTD,        |                                                                  |

|     |             |                               |                                      |                                                                                                                                                                       |
|-----|-------------|-------------------------------|--------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 88  | 145-35000-A | LEVEL SWITCH-CAPACITANCE TYPE | Flow Star Engineering Pvt. Ltd.,     |                                                                                                                                                                       |
| 89  | 145-35000-A | LEVEL SWITCH-CAPACITANCE TYPE | NIVO CONTROLS PVT. LTD.              | For Capacitance type level switch.                                                                                                                                    |
| 90  | 145-35000-A | LEVEL SWITCH-CAPACITANCE TYPE | Baumer Technologies India Pvt. Ltd.  |                                                                                                                                                                       |
| 91  | 145-35000-A | LEVEL SWITCH-CAPACITANCE TYPE | Pune Techtrol Pvt. Ltd.              |                                                                                                                                                                       |
| 92  | 145-35000-A | LEVEL SWITCH-CAPACITANCE TYPE | BLISS ANAND PVT. LTD.                |                                                                                                                                                                       |
| 93  | 145-35000-A | LEVEL SWITCH-CAPACITANCE TYPE | SOR INC.                             |                                                                                                                                                                       |
| 94  | 145-35000-A | LEVEL SWITCH-CAPACITANCE TYPE | LEVCON INSTRUMENTS PVT. LTD.         |                                                                                                                                                                       |
| 95  | 145-36000-A | LEVEL SWITCH-CONDUTIVITY TYPE | SOR INC.                             |                                                                                                                                                                       |
| 96  | 145-36000-A | LEVEL SWITCH-CONDUTIVITY TYPE | LEVCON INSTRUMENTS PVT. LTD.         |                                                                                                                                                                       |
| 97  | 145-36000-A | LEVEL SWITCH-CONDUTIVITY TYPE | V. AUTOMAT & INSTRUMENTS (P) LTD.    |                                                                                                                                                                       |
| 98  | 145-36000-A | LEVEL SWITCH-CONDUTIVITY TYPE | HI-TECH SYSTEMS & SERVICES LTD.      | Vendor shall source import contents of Level Switch (Conductivity Type) from Levelstate Systems Ltd., United Kingdom.                                                 |
| 99  | 145-36000-A | LEVEL SWITCH-CONDUTIVITY TYPE | RAMAN INSTRUMENTS PVT.LTD.           | Vendor shall source import contents of Level Switch (Conductivity Type) from Mobrey Measurement, an operating unit of Morbey Ltd., Slough, Berkshire, United Kingdom. |
| 100 | 145-36000-A | LEVEL SWITCH-CONDUTIVITY TYPE | Sapcon Instrument Pvt Ltd.           |                                                                                                                                                                       |
| 101 | 145-36000-A | LEVEL SWITCH-CONDUTIVITY TYPE | SIGMA INSTRUMENTS CO.                |                                                                                                                                                                       |
| 102 | 145-36000-A | LEVEL SWITCH-CONDUTIVITY TYPE | BLISS ANAND PVT. LTD.                |                                                                                                                                                                       |
| 103 | 145-37000-A | LEVEL SWITCH-FLOAT TYPE       | SIGMA INSTRUMENTS CO.                |                                                                                                                                                                       |
| 104 | 145-37000-A | LEVEL SWITCH-FLOAT TYPE       | Pune Techtrol Pvt. Ltd.              |                                                                                                                                                                       |
| 105 | 145-37000-A | LEVEL SWITCH-FLOAT TYPE       | D.K. INSTRUMENTS PVT.LTD.            |                                                                                                                                                                       |
| 106 | 145-37000-A | LEVEL SWITCH-FLOAT TYPE       | V. AUTOMAT & INSTRUMENTS (P) LTD.    |                                                                                                                                                                       |
| 107 | 145-37000-A | LEVEL SWITCH-FLOAT TYPE       | SCIENTIFIC DEVICES (BOMBAY) PVT LTD, |                                                                                                                                                                       |
| 108 | 145-37000-A | LEVEL SWITCH-FLOAT TYPE       | LEVCON INSTRUMENTS PVT. LTD.         |                                                                                                                                                                       |
| 109 | 145-37000-A | LEVEL SWITCH-FLOAT TYPE       | GENERAL INSTRUMENTS CONSORTIUM       |                                                                                                                                                                       |
| 110 | 145-37000-A | LEVEL SWITCH-FLOAT TYPE       | Baumer Technologies India Pvt. Ltd.  |                                                                                                                                                                       |
| 111 | 145-37000-A | LEVEL SWITCH-FLOAT TYPE       | SBEM PVT. LTD.                       |                                                                                                                                                                       |
| 112 | 145-37000-A | LEVEL SWITCH-FLOAT TYPE       | SOR INC.                             |                                                                                                                                                                       |
| 113 | 145-37000-A | LEVEL SWITCH-FLOAT TYPE       | BLISS ANAND PVT. LTD.                |                                                                                                                                                                       |
| 114 | 145-38000-A | INSTRUMENTS PIPE FITTINGS     | VIKAS INDUSTRIAL PRODUCTS            |                                                                                                                                                                       |
| 115 | 145-38000-A | INSTRUMENTS PIPE FITTINGS     | Fluid Controls Pvt. Ltd.             |                                                                                                                                                                       |
| 116 | 145-38000-A | INSTRUMENTS PIPE FITTINGS     | PRECISION ENGINEERING INDUSTRIES     |                                                                                                                                                                       |
| 117 | 145-38000-A | INSTRUMENTS PIPE FITTINGS     | AURA INCORPORATED                    |                                                                                                                                                                       |
| 118 | 145-42000-A | ULTRASONIC FLOW METERS        | CHEMTROLS INDUSTRIES PVT. LTD.       | For Flexim Fluxus non-invasive ultrasonic flowmeter only;                                                                                                             |
| 119 | 145-42000-A | ULTRASONIC FLOW METERS        | Rockwin Flowmeter India Pvt. Ltd.    |                                                                                                                                                                       |
| 120 | 145-42000-A | ULTRASONIC FLOW METERS        | FLASH FORGE PVT LTD                  |                                                                                                                                                                       |

|     |                                                                                                                                                                                                                                                                                                                                                          |                            |                                                   |                            |
|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------------------------------|----------------------------|
| 121 | 145-42000-A                                                                                                                                                                                                                                                                                                                                              | ULTRASONIC FLOW METERS     | NIVUS GMBH                                        |                            |
| 122 | 145-43000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - ORIFICE     | MINCO (INDIA) FLOW ELEMENTS PVT. LTD.             |                            |
| 123 | 145-43000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - ORIFICE     | STAR-MECH CONTROLS (I) PVT.LTD.                   |                            |
| 124 | 145-43000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - ORIFICE     | TANSA EQUIPMENTS PVT. LTD.                        |                            |
| 125 | 145-43000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - ORIFICE     | SCIENTIFIC DEVICES (BOMBAY) PVT LTD,              |                            |
| 126 | 145-43000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - ORIFICE     | DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.       |                            |
| 127 | 145-43000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - ORIFICE     | MICRO PRECISION PRODUCTS PVT. LTD.                |                            |
| 128 | 145-43000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - ORIFICE     | INSTRUMENTATION LTD.                              |                            |
| 129 | 145-43000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - ORIFICE     | HYDROPNEUMATICS PVT. LTD.                         |                            |
| 130 | 145-43000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - ORIFICE     | Flow Star Engineering Pvt. Ltd.,                  |                            |
| 131 | 145-43000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - ORIFICE     | CHEMTROLS INDUSTRIES PVT. LTD.                    |                            |
| 132 | 145-43000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - ORIFICE     | INSTRUMENTATION ENGINEERS PVT LTD                 |                            |
| 133 | 145-44000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - NOZZLE      | DYNAFLUID VALVES AND FLOW CONTROLS (P) LTD.       | except P91 material pipes; |
| 134 | 145-44000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - NOZZLE      | MINCO (INDIA) FLOW ELEMENTS PVT. LTD.             |                            |
| 135 | 145-44000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - NOZZLE      | HYDROPNEUMATICS PVT. LTD.                         |                            |
| 136 | 145-44000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - NOZZLE      | STAR-MECH CONTROLS (I) PVT.LTD.                   |                            |
| 137 | 145-44000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - NOZZLE      | INSTRUMENTATION LTD.                              |                            |
| 138 | 145-44000-A                                                                                                                                                                                                                                                                                                                                              | FLOW ELEMENT - NOZZLE      | MICRO PRECISION PRODUCTS PVT. LTD.                |                            |
| 139 | 145-45000-A                                                                                                                                                                                                                                                                                                                                              | INSTRUMENT FITTINGS        | Perfect Instrumentation Control (India) Pvt. Ltd. |                            |
| 140 | 145-45000-A                                                                                                                                                                                                                                                                                                                                              | INSTRUMENT FITTINGS        | Arya Crafts & Engineering Pvt. Ltd.               |                            |
| 141 | 145-45000-A                                                                                                                                                                                                                                                                                                                                              | INSTRUMENT FITTINGS        | Comfit & Valve Pvt. Ltd.                          |                            |
| 142 | 145-45000-A                                                                                                                                                                                                                                                                                                                                              | INSTRUMENT FITTINGS        | HP VALVES & FITTINGS INDIA PVT. LTD.              |                            |
| 143 | 145-45000-A                                                                                                                                                                                                                                                                                                                                              | INSTRUMENT FITTINGS        | AURA INCORPORATED                                 |                            |
| 144 | 145-45000-A                                                                                                                                                                                                                                                                                                                                              | INSTRUMENT FITTINGS        | PRECISION ENGINEERING INDUSTRIES                  |                            |
| 145 | 145-45000-A                                                                                                                                                                                                                                                                                                                                              | INSTRUMENT FITTINGS        | FLUIDFIT ENGINEERS PVT. LTD.                      |                            |
| 146 | 145-45000-A                                                                                                                                                                                                                                                                                                                                              | INSTRUMENT FITTINGS        | VIKAS INDUSTRIAL PRODUCTS                         |                            |
| 147 | 145-45000-A                                                                                                                                                                                                                                                                                                                                              | INSTRUMENT FITTINGS        | Fluid Controls Pvt. Ltd.                          |                            |
| 148 | 145-45000-A                                                                                                                                                                                                                                                                                                                                              | INSTRUMENT FITTINGS        | PANAM ENGINEERS                                   |                            |
| 149 | 145-47000-A                                                                                                                                                                                                                                                                                                                                              | ELECTROMAGNETIC FLOW METER | Electronet Equipments Pvt Ltd.                    |                            |
| 150 | 145-47000-A                                                                                                                                                                                                                                                                                                                                              | ELECTROMAGNETIC FLOW METER | Adept Fluidyne Pvt. Ltd.                          |                            |
| 151 | 145-47000-A                                                                                                                                                                                                                                                                                                                                              | ELECTROMAGNETIC FLOW METER | SCIENTIFIC DEVICES (BOMBAY) PVT LTD,              |                            |
| 152 |                                                                                                                                                                                                                                                                                                                                                          |                            |                                                   |                            |
|     | <u>NOTES:</u><br>i) The above sub-vendor list is tentative & for reference only. However Sub-Vendor List is subject to BHEL/ end user approval without any commercial/ delivery implication.<br>ii) New Sub-Vendor if proposed by Vendor during contract stage shall be subject to BHEL/ end user approval without any commercial/ delivery implication. |                            |                                                   |                            |

| 2 X 660 MW MAITREE STPP                         |                                                                                                                                                                                                                                                        |                                                              |          |                               |                                           |
|-------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|----------|-------------------------------|-------------------------------------------|
| LIST OF DELIVERABLES (C&I) FOR COLTCS / SCS /DF |                                                                                                                                                                                                                                                        |                                                              |          |                               |                                           |
| S.No.                                           | DRAWING NO.                                                                                                                                                                                                                                            | DRAWING/DOCUMENT TITLE                                       | CATEGORY | SCH. SUBMISSION WEEK FROM LOI | Resubmission after incorporating comments |
| 1                                               | PE-V0-421-165-I901                                                                                                                                                                                                                                     | CONTROL & OPERATIONAL WRITE-UP FOR THE SYSTEM                | A        | 5                             | 1 week                                    |
| 2                                               | PE-V0-421-165-I902                                                                                                                                                                                                                                     | INSTRUMENT & DRIVE LIST WITH SET POINTS                      | A        | 8                             | 1 week                                    |
| 3                                               | PE-V0-421-165-I903                                                                                                                                                                                                                                     | FIELD JB/LIE/LIR,DRIVES TERMINATION DETAILS                  | A        | 9                             | 1 week                                    |
| 4                                               | PE-V0-421-165-I904                                                                                                                                                                                                                                     | DATASHEETS FOR INSTRUMENTS, JBs, etc. along with CATALOGUES* | A        | 8                             | 1 week                                    |
| 5                                               | PE-V0-421-165-I905                                                                                                                                                                                                                                     | INPUT / OUTPUT SIGNAL LIST (ANALOG & BINARY)                 | A        | 8                             | 1 week                                    |
| 6                                               | PE-V0-421-165-I906                                                                                                                                                                                                                                     | ANNUNCIATION & SOE LIST                                      | A        | 8                             | 1 week                                    |
| 7                                               | PE-V0-421-165-I907                                                                                                                                                                                                                                     | QUALITY PLANS (INSTRUMENTS,LCP etc.)                         | A        | 6                             | 1 week                                    |
| 8                                               | PE-V0-421-165-I908                                                                                                                                                                                                                                     | INSTRUMENT INSTALLATION/ HOOK-UP DRAWING                     | A        | 6                             | 1 week                                    |
| 9                                               | PE-V0-421-165-I909                                                                                                                                                                                                                                     | & INTERCONNECTION DETAILS                                    | A        | 8                             | 1 week                                    |
| 10                                              | PE-V0-421-165-I910                                                                                                                                                                                                                                     | O & M MANUAL                                                 | A        | 10                            | 1 week                                    |
| 11                                              | PE-V0-421-165-I911                                                                                                                                                                                                                                     | GA & Wiring diagram of Local Control Panels                  | A        | 8                             | 1 week                                    |
|                                                 | NOTES:                                                                                                                                                                                                                                                 |                                                              |          |                               |                                           |
| 1                                               | Any other document for the package decided during detailed engineering shall be provided by Bidder without any commercial/ technical implication.                                                                                                      |                                                              |          |                               |                                           |
| 2                                               | Reusable database format like MS Excel, MS Access etc. of these documents shall also be provided by Contractor in BHEL approved format. Soft copy of the formats as applicable shall be provided to the successful bidder during detailed engineering. |                                                              |          |                               |                                           |



TITLE:

**TECHNICAL SPECIFICATION  
SELF CLEANING STRAINER**

**STANDARD TECHNICAL REQUIREMENTS**

SPEC. NO.: **PE-TS-421-165-N004**

SECTION: **III**

SUB-SECTION:

REV. NO. 0 DATE 20.12.2017

SHEET 1 OF 1

### **SECTION III**

**DOCUMENTS TO BE SUBMITTED BY BIDDER**

|                                                                                   |                                                                      |                  |                                      |
|-----------------------------------------------------------------------------------|----------------------------------------------------------------------|------------------|--------------------------------------|
|  | <b>TITLE : COMPLIANCE CERTIFICATE<br/>FOR SELF CLEANING STRAINER</b> | <b>SPEC. NO.</b> | <b>SPEC. NO. PE-TS- 421-165-N004</b> |
|                                                                                   |                                                                      | <b>DATE:</b>     | 20.12.2017                           |
|                                                                                   |                                                                      | <b>SHEET:</b>    | 1 OF 2                               |

### **COMPLIANCE CERTIFICATE**

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

- a) The scope of supply, technical details, construction features, design parameters etc. shall be as per technical specification & there are no exclusions with regard to same.
- b) There are no other deviations w.r.t. specification other than those furnished in the 'Schedule of Deviations'. Any other deviation, stated or implied, taken elsewhere in the offer stands withdrawn unless specifically brought out in the 'Schedule of Deviations'
- c) Bidder shall submit QP in the event of order based on the guidelines given in the specification & QP enclosed therein. QP will be subject to BHEL/ Customer/Customer's Consultant approval and customer hold points for inspection/ testing shall be marked in the QP at the contract stage. Inspection/ testing shall be witnessed as per same apart from review of various test certificates/ Inspection records etc. Charges for 3<sup>rd</sup> party inspection (TUV/ equivalent) for imported components wherever required shall be included by bidder in the base price itself.
- d) Any drawing/ document/ data-sheet/ calculation/ Quality plan/ Instrumentation etc. submitted along with the offer shall be considered for reference only, same shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
- e) The offered materials shall be either equivalent or superior to those specified in the specification. For components where materials are not specified, same shall be suitable for intended duty, all materials shall be subject to approval in the event of order.
- f) The commissioning spares shall be supplied on 'As Required Basis' and to be supplied at the time of commissioning of SCS & prices for same included in the base price itself. Prices for special tools & tackles, if any, shall also be included in the base price. Recommended spares for 3 years shall be quoted separately with price indicated separately.
- g) Charges for Installation Checks, Commissioning of equipment, Trial run and Performance Testing at site shall be included by bidder in the base price itself.
- h) The main flanges for SCS shall be suitable for the forces and moments as per the specification.
- i) The hydrostatic test pressure shall be 1.5 times the design pressure.
- j) All sub - vendors shall be subject to BHEL/ Customer/Customer's Consultant approval in the event of order.
- k) The Performance guarantees of equipment shall stand valid till the satisfactory completion of performance testing & its acceptance by BHEL/ Customer/Customer's Consultant.
- l) The orientation of piping around SCS shall be finalised during detailed Engg.
- m) Electrical/ C&I :
  - All selected motor ratings have minimum 15 % margin over maximum continuous demand of the driven equipment including voltage and frequency variations, temperature rise and other factors.
  - Supply of electrical viz. LT power cables, instrumentation and control cables, cable glands, lugs, cable trays etc. shall be as per specification. Their erection shall be done by BHEL



**TITLE : COMPLIANCE CERTIFICATE  
FOR SELF CLEANING STRAINER**

**SPEC. NO.**

**SPEC. NO. PE-TS- 421-165-N004**

**DATE:**

20.12.2017

**SHEET:**

2 OF 2

- The junction boxes for termination of DPT/ DPS/ Actuator LS/ solenoid valves are included in bidder's scope. The instrumentation cable and cabling from instruments/ actuators to junction boxes is also included in bidder's scope.
- Valve actuators and controls shall be provided as specified in Data Sheet-A and Project specific requirements as specified in Section I-B & Section I-C.
- Alarms/ annunciations/ instruments shall be finalised during detailed engineering in the event of order which shall be subject to BHEL/ Customer/Customer's Consultant approval and shall be without any commercial implications to BHEL.
- Switch gear panel should have suitable arrangement like bus coupler for providing redundancy to incoming supply feeder.
- For design & standards of Self-cleaning strainers (Materials specification, pumps, piping, flanges, valves, testing procedures etc) please refer clause no B.0.6.2 of Appendix-1(C)/SECTION-1A (SPECIFIC TECHNICAL REQUIREMENT-MECHANICAL)
- Indian Standards and Chinese Standards are NOT acceptable. Wherever international standards have been mentioned same shall not include Indian and Chinese standards.
- Wherever 'IS' code is indicated in this specification, equivalent international code is to be used inline with the above.

|                                                                                  |                                                                                            |                                                        |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------|--------------------------------------------------------|
|  | <b>TITLE : SCHEDULE OF PERFORMANCE GUARANTEES<br/>FOR<br/>SELF CLEANING STRAINER (SCS)</b> | <b>TECHNICAL SPECIFICATION NO. PE-TS- 421-165-N004</b> |
|                                                                                  |                                                                                            | <b>SECTION : III</b>                                   |
|                                                                                  |                                                                                            | <b>SUB SECTION : IIIA</b>                              |
|                                                                                  |                                                                                            | <b>Sheet 1 of 1 Date- 20.12.2017</b>                   |

| S.NO. | DESCRIPTION                                                                                                       | UNITS | 2 x 660 MW MAITREE BANGLADESH |
|-------|-------------------------------------------------------------------------------------------------------------------|-------|-------------------------------|
| 1.    | Pressure drop across the SCS (i.e. between inlet & outlet nozzle) under clean condition and Normal flow condition | MWC   |                               |

| PARTICULARS OF BIDDER/ AUTHORISED REPRESENTATIVE |             |           |      |              |
|--------------------------------------------------|-------------|-----------|------|--------------|
| NAME                                             | DESIGNATION | SIGNATURE | DATE |              |
|                                                  |             |           |      | COMPANY SEAL |

[illegible]

|                                                                                   |                        |                   |
|-----------------------------------------------------------------------------------|------------------------|-------------------|
|                                                                                   | TITLE :                | SPECIFICATION NO. |
| 01/04/05 PM                                                                       | DATA SHEET - B         | VOLUME : III - B  |
|  | SELF - CLEANING FILTER | SECTION : B       |
|                                                                                   | ( Backwash Type )      | REV. NO. 00       |
|                                                                                   |                        | DATE :            |
|                                                                                   |                        | SHEET 1 OF 3      |

| SL.NO. | DESCRIPTION                                             | UNIT    | DATA/ PARTICULARS |
|--------|---------------------------------------------------------|---------|-------------------|
| 1.0    | GENERAL                                                 |         |                   |
| 1.1    | No. of filters required                                 | Nos.    |                   |
| 1.2    | Inlet connection                                        | mm Nb   |                   |
| 1.3    | Outlet connection                                       | mm Nb   |                   |
| 1.4    | Filter type/ duty                                       |         |                   |
| 1.5    | Location                                                |         |                   |
| 1.6    | Liquid handled                                          |         |                   |
| 2.0    | DESIGN DATA                                             |         |                   |
| 2.1    | Operating pressure                                      | Bar (g) |                   |
| 2.2    | Design pressure                                         | Bar (g) |                   |
| 2.3    | Design temperature                                      | Deg. C  |                   |
| 2.4    | Flow rate through filter                                |         |                   |
|        | a) Normal                                               |         |                   |
|        | b) Maximum                                              |         |                   |
| 2.5    | Design differential pressure for filter section/ screen | Bar (g) |                   |
| 2.6    | Max. Size of solid particle likely to enter the filter  | mm      |                   |
| 2.7    | Type of suspended matter likely to enter the filter     |         |                   |
| 2.8    | Differential pressure measuring system set pressure     |         |                   |
|        | • For initiating flushing/ backwashing                  | mbar    |                   |
|        | • For alarm/ annunciation                               | mbar    |                   |
| 2.9    | Filter section/ screen perforation size                 | mm      |                   |
| 3.0    | GUARANTEED PERFORMANCE REQUIREMENT                      |         |                   |

|                                                                                   |                        |                         |
|-----------------------------------------------------------------------------------|------------------------|-------------------------|
|  | TITLE :                | SPECIFICATION NO.       |
|                                                                                   | DATA SHEET - B         | VOLUME : III - B        |
|                                                                                   | SELF - CLEANING FILTER | SECTION : B             |
|                                                                                   | ( Backwash Type )      | REV. NO. 00      DATE : |
|                                                                                   |                        | SHEET 2 OF 3            |

| SL.NO. | DESCRIPTION                                                                | UNIT               | DATA/ PARTICULARS |
|--------|----------------------------------------------------------------------------|--------------------|-------------------|
| 3.1    | Pressure drop across the filter (i.e. between inlet and outlet connection) | mbar               |                   |
|        | a) Clean condition                                                         |                    |                   |
|        | b) Partially (50%) choked condition                                        |                    |                   |
|        | c) During flushing operation                                               |                    |                   |
|        | d) After flushing operation                                                |                    |                   |
| 3.2    | Debris discharge flow during flushing period                               |                    |                   |
| 3.3    | Flushing period                                                            | Minutes            |                   |
| 3.4    | Debris/ sludge removal capacity                                            | m <sup>3</sup> /hr |                   |
| 4.0    | <b>MATERIALS OF CONSTRUCTION</b>                                           |                    |                   |
| 4.1    | Filter body/ housing                                                       |                    |                   |
| 4.2    | Filter screen/ section                                                     |                    |                   |
| 4.3    | Supporting cage                                                            |                    |                   |
| 4.4    | Differential measuring system                                              |                    |                   |
| 4.5    | Flushing/ backwashing unit                                                 |                    |                   |
| 4.6    | Backwash rotor shoes                                                       |                    |                   |
| 4.7    | Internal hardware                                                          |                    |                   |
| 4.8    | Pipes                                                                      |                    |                   |
| 4.9    | Shaft                                                                      |                    |                   |
| 5.0    | <b>COUNTER FLANGES</b>                                                     |                    |                   |
| 5.1    | Materials :                                                                |                    |                   |
|        | a) Flanges                                                                 |                    |                   |
|        | b) Bolts & Nuts                                                            |                    |                   |
|        | c) Gaskets                                                                 |                    |                   |
| 5.2    | Drilling Standard                                                          |                    |                   |

|                                                                                   |                        |                         |
|-----------------------------------------------------------------------------------|------------------------|-------------------------|
|  | TITLE :                | SPECIFICATION NO.       |
|                                                                                   | DATA SHEET - B         | VOLUME : III - B        |
|                                                                                   | SELF - CLEANING FILTER | SECTION : B             |
|                                                                                   | ( Backwash Type )      | REV. NO. 00      DATE : |
|                                                                                   |                        | SHEET 3 OF 3            |

| SL.NO. | DESCRIPTION            | UNIT    | DATA/ PARTICULARS |
|--------|------------------------|---------|-------------------|
| 6.0    | <b>PAINTING</b>        |         |                   |
| 6.1    | External Surface       |         |                   |
|        | 1. Surface preparation |         |                   |
|        | 2. Primer              |         |                   |
|        | 3. Final paint         |         |                   |
| 6.2    | Internal Surface       |         |                   |
|        | a) Surface preparation |         |                   |
|        | a) Primer              |         |                   |
|        | b) Final paint         |         |                   |
| 7.0    | <b>SHOP TEST</b>       |         |                   |
| 7.1    | Hydrostatic test       |         |                   |
|        | a) Test Pressure       | bar (g) |                   |
|        | b) Test duration       | min.    |                   |
| 7.2    | Lekage test            |         |                   |
|        | a) Test Pressure       | bar (g) |                   |
|        | b) Test duration       | min.    |                   |