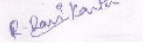
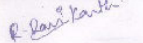
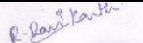
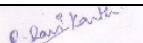
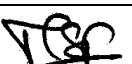
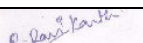
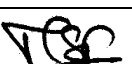
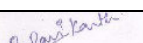
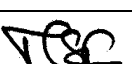
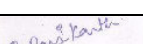
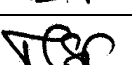
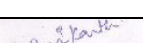
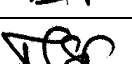
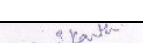
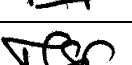
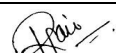
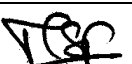
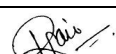
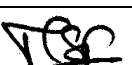
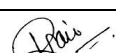
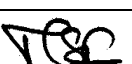
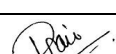
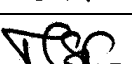
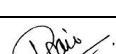
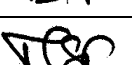
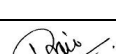
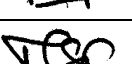
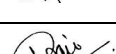
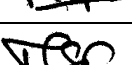
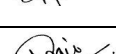
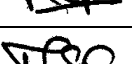
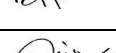
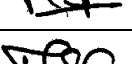


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| TD-106-1<br>Rev No. 5<br>Form No.                                                                                                                                                                                                                                                              | <br>HYDERABAD | <b>PRODUCT STANDARD</b><br><b>BHEL, HYDERABAD –502032.</b><br><b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b> |                                                 |                                         |                                                 | <b>PY51222</b>                       |
|                                                                                                                                                                                                                                                                                                |                                                                                                |                                                                                                                 |                                                 |                                         |                                                 | Rev No. 17                           |
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| Ref. Doc                                                                                                                                                                                                                                                                                       |                                                                                                | <b>Revisions :17</b><br><br><b>Refer to record of revisions :</b>                                               | <b>Prepared :</b><br>-sd-<br><b>RAJEEV JAIN</b> | <b>Checked</b><br>-sd-<br><b>GIRISH</b> | <b>Approved :</b><br>-sd-<br><b>SIVA PRASAD</b> | <b>Date :</b><br><br><b>27.06.17</b> |

| TD-106-2<br>Rev No. 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Form No.                                                                         | <br>HYDERABAD | <b>PRODUCT STANDARD</b><br><b>BHEL, HYDERABAD -502032.</b><br><b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b> |                 | <b>PY51222</b> |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |            |    |                                               |              |            |            |    |                                      |              |            |            |    |                                   |  |            |          |    |                                 |              |            |            |    |                                 |              |            |            |    |                                                            |              |            |            |    |                                                                                  |              |            |            |    |                               |              |            |      |    |                                     |              |            |            |    |                                                            |              |            |            |    |                         |              |                      |                 |    |                                      |              |                      |                 |    |                                     |              |                      |                 |    |                           |              |                      |                 |  |  |  |  |  |
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| Please refer specification, Doc. No. PY-AS-4-M096-8369-01 & annexures for Details.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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| <b><u>VARIANT TABLE</u></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            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| <table border="1"> <thead> <tr> <th>Variant No.</th> <th>Item</th> <th>Material code</th> <th>Job Specification</th> <th>Project</th> </tr> </thead> <tbody> <tr><td>07</td><td>POTABLE PUMP WITH MOTOR</td><td></td><td>PEMC-06584</td><td>ONGC-H</td></tr> <tr><td>08</td><td>SPARES POTABLE PUMP WITH MOTOR</td><td></td><td>PEMC-06584</td><td>ONGC-H</td></tr> <tr><td>09</td><td>BLOWDOWN TRANSFER PUMP</td><td></td><td>PEMC-06649</td><td>BCPL</td></tr> <tr><td>10</td><td>CEP WITH DRIVE</td><td></td><td>PEMC-06678</td><td>RSPL</td></tr> <tr><td>11</td><td>CEP with Drive Motor</td><td></td><td>PEMC-06648</td><td>NIRMA</td></tr> <tr><td>12</td><td>CFP with Drive Motor</td><td></td><td>PEMC-06674</td><td>NIRMA</td></tr> <tr><td>13</td><td>Spares for CFP with Drive Motor</td><td></td><td>PEMC-06674</td><td>NIRMA</td></tr> <tr><td>14</td><td>Dewatering Pump Weather proof</td><td></td><td>PEMC-06718</td><td>ONGC-H</td></tr> <tr><td>15</td><td>Dewatering Pump Ex 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assembly</td><td>PY9751222230</td><td>PEMC-06853</td><td>TATA STEEL</td></tr> <tr><td>24</td><td>C&amp;I Mandatory Spares for HRSG BFP</td><td></td><td>PEMC-05923</td><td>CPCL-GTG</td></tr> <tr><td>25</td><td>Dirty Oil Pump with drive motor</td><td>PY9751222257</td><td>PEMC-06875</td><td>TATA STEEL</td></tr> <tr><td>26</td><td>Clean Oil Pump with drive motor</td><td>PY9751222265</td><td>PEMC-06875</td><td>TATA STEEL</td></tr> <tr><td>27</td><td>Dewatering Sump pump with drive motor for SSF Backwash pit</td><td>PY9751222273</td><td>PEMC-06906</td><td>TATA STEEL</td></tr> <tr><td>29</td><td>Supervision of E&amp;C of Dewatering Sump pump with drive motor for SSF Backwash pit</td><td>PY9751222273</td><td>PEMC-06906</td><td>TATA STEEL</td></tr> <tr><td>30</td><td>Coupling for CTP Motor driven</td><td>PY9751222303</td><td>PEMC-06983</td><td>BCPL</td></tr> <tr><td>28</td><td>Potable water pump with drive motor</td><td>PY9751222281</td><td>PEMC-06935</td><td>TATA STEEL</td></tr> <tr><td>35</td><td>Supervision of E&amp;C for Potable water pump with drive motor</td><td>PY9751222356</td><td>PEMC-06935</td><td>TATA STEEL</td></tr> <tr><td>40</td><td>Raw Sewage Lifting Pump</td><td>PY9751222400</td><td>PY-AS-4-M096-8369-01</td><td>STP,BHEL BHOPAL</td></tr> <tr><td>41</td><td>Return Activated Sewage Sludge Pumps</td><td>PY9751222419</td><td>PY-AS-4-M096-8369-01</td><td>STP,BHEL BHOPAL</td></tr> <tr><td>42</td><td>Waste Activated Sewage Sludge Pumps</td><td>PY9751222427</td><td>PY-AS-4-M096-8369-01</td><td>STP,BHEL BHOPAL</td></tr> <tr><td>43</td><td>Screw Sludge Lifting Pump</td><td>PY9751222435</td><td>PY-AS-4-M096-8371-01</td><td>STP,BHEL BHOPAL</td></tr> <tr><td></td><td></td><td></td><td></td><td></td></tr> </tbody> </table> |                                                                                  |                                                                                                |                                                                                                                 |                 |                | Variant No. | Item | Material code | Job Specification | Project | 07 | POTABLE PUMP WITH MOTOR |  | PEMC-06584 | ONGC-H | 08 | SPARES POTABLE PUMP WITH MOTOR |  | PEMC-06584 | ONGC-H | 09 | BLOWDOWN TRANSFER PUMP |  | PEMC-06649 | BCPL | 10 | CEP WITH DRIVE |  | PEMC-06678 | RSPL | 11 | CEP with Drive Motor |  | PEMC-06648 | NIRMA | 12 | CFP with Drive Motor |  | PEMC-06674 | NIRMA | 13 | Spares for CFP with Drive Motor |  | PEMC-06674 | NIRMA | 14 | Dewatering Pump Weather proof |  | PEMC-06718 | ONGC-H | 15 | Dewatering Pump Ex proof |  | PEMC-06718 | ONGC-H | 16 | Vertical sump pump GT-3 area |  | PEMC-06719 | ONGC-H | 17 | Mand spares for Vertical sump pump GT-3 area |  | PEMC-06719 | ONGC-H | 18 | Closed Cooling water pump with drive motor |  | PEMC-6713 | KPCL-Yelhanka | 19 | Spares for Closed Cooling water pump with drive motors |  | PEMC-6713 | KPCL-Yelhanka | 20 | CEP with Drive Motor assembly | PY9751222206 | PEMC-06773 | NMDC | 21 | CEP with Drive Motor assembly | PY9751222214 | PEMC-06829 | TATA STEEL | 22 | Cooling water Pumps with Drive Motor assembly | PY9751222222 | PEMC-06839 | TATA STEEL | 23 | DMCW Pumps with Drive Motor assembly | PY9751222230 | PEMC-06853 | TATA STEEL | 24 | C&I Mandatory Spares for HRSG BFP |  | PEMC-05923 | CPCL-GTG | 25 | Dirty Oil Pump with drive motor | PY9751222257 | PEMC-06875 | TATA STEEL | 26 | Clean Oil Pump with drive motor | PY9751222265 | PEMC-06875 | TATA STEEL | 27 | Dewatering Sump pump with drive motor for SSF Backwash pit | PY9751222273 | PEMC-06906 | TATA STEEL | 29 | Supervision of E&C of Dewatering Sump pump with drive motor for SSF Backwash pit | PY9751222273 | PEMC-06906 | TATA STEEL | 30 | Coupling for CTP Motor driven | PY9751222303 | PEMC-06983 | BCPL | 28 | Potable water pump with drive motor | PY9751222281 | PEMC-06935 | TATA STEEL | 35 | Supervision of E&C for Potable water pump with drive motor | PY9751222356 | PEMC-06935 | TATA STEEL | 40 | Raw Sewage Lifting Pump | PY9751222400 | PY-AS-4-M096-8369-01 | STP,BHEL BHOPAL | 41 | Return Activated Sewage Sludge Pumps | PY9751222419 | PY-AS-4-M096-8369-01 | STP,BHEL BHOPAL | 42 | Waste Activated Sewage Sludge Pumps | PY9751222427 | PY-AS-4-M096-8369-01 | STP,BHEL BHOPAL | 43 | Screw Sludge Lifting Pump | PY9751222435 | PY-AS-4-M096-8371-01 | STP,BHEL BHOPAL |  |  |  |  |  |
| Variant No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            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            |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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            |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 09                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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            |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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            |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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            |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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            |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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| 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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            |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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   |                                      |              |                      |                 |    |                                     |              |                      |                 |    |                           |              |                      |                 |  |  |  |  |  |
| 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Closed Cooling water pump with drive motor                                       |                                                                                                | PEMC-6713                                                                                                       | KPCL-Yelhanka   |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Spares for Closed Cooling water pump with drive motors                           |                                                                                                | PEMC-6713                                                                                                       | KPCL-Yelhanka   |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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   |                                      |              |                      |                 |    |                                     |              |                      |                 |    |                           |              |                      |                 |  |  |  |  |  |
| 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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            |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 21                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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            |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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            |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     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            |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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   |                                      |              |                      |                 |    |                                     |              |                      |                 |    |                           |              |                      |                 |  |  |  |  |  |
| 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | C&I Mandatory Spares for HRSG BFP                                                |                                                                                                | PEMC-05923                                                                                                      | CPCL-GTG        |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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   |                                      |              |                      |                 |    |                                     |              |                      |                 |    |                           |              |                      |                 |  |  |  |  |  |
| 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Dirty Oil Pump with drive motor                                                  | PY9751222257                                                                                   | PEMC-06875                                                                                                      | TATA STEEL      |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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   |                                      |              |                      |                 |    |                                     |              |                      |                 |    |                           |              |                      |                 |  |  |  |  |  |
| 26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Clean Oil Pump with drive motor                                                  | PY9751222265                                                                                   | PEMC-06875                                                                                                      | TATA STEEL      |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Dewatering Sump pump with drive motor for SSF Backwash pit                       | PY9751222273                                                                                   | PEMC-06906                                                                                                      | TATA STEEL      |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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   |                                      |              |                      |                 |    |                                     |              |                      |                 |    |                           |              |                      |                 |  |  |  |  |  |
| 29                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Supervision of E&C of Dewatering Sump pump with drive motor for SSF Backwash pit | PY9751222273                                                                                   | PEMC-06906                                                                                                      | TATA STEEL      |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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   |                                      |              |                      |                 |    |                                     |              |                      |                 |    |                           |              |                      |                 |  |  |  |  |  |
| 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Coupling for CTP Motor driven                                                    | PY9751222303                                                                                   | PEMC-06983                                                                                                      | BCPL            |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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   |                                      |              |                      |                 |    |                                     |              |                      |                 |    |                           |              |                      |                 |  |  |  |  |  |
| 28                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Potable water pump with drive motor                                              | PY9751222281                                                                                   | PEMC-06935                                                                                                      | TATA STEEL      |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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   |                                      |              |                      |                 |    |                                     |              |                      |                 |    |                           |              |                      |                 |  |  |  |  |  |
| 35                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Supervision of E&C for Potable water pump with drive motor                       | PY9751222356                                                                                   | PEMC-06935                                                                                                      | TATA STEEL      |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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   |                                      |              |                      |                 |    |                                     |              |                      |                 |    |                           |              |                      |                 |  |  |  |  |  |
| 40                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Raw Sewage Lifting Pump                                                          | PY9751222400                                                                                   | PY-AS-4-M096-8369-01                                                                                            | STP,BHEL BHOPAL |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 41                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Return Activated Sewage Sludge Pumps                                             | PY9751222419                                                                                   | PY-AS-4-M096-8369-01                                                                                            | STP,BHEL BHOPAL |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 42                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Waste Activated Sewage Sludge Pumps                                              | PY9751222427                                                                                   | PY-AS-4-M096-8369-01                                                                                            | STP,BHEL BHOPAL |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| 43                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Screw Sludge Lifting Pump                                                        | PY9751222435                                                                                   | PY-AS-4-M096-8371-01                                                                                            | STP,BHEL BHOPAL |                |             |      |               |                   |         |    |                         |  |            |        |    |                                |  |            |        |    |                        |  |            |      |    |                |  |            |      |    |                      |  |            |       |    |                      |  |            |       |    |                                 |  |            |       |    |                               |  |            |        |    |                          |  |            |        |    |                              |  |            |        |    |                                              |  |            |        |    |                                            |  |           |               |    |                                                        |  |           |               |    |                               |              |            |      |    |                               |              |            |      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| Ref. Doc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      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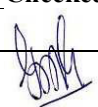
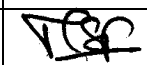
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| TD-106-3<br>Rev No. 5<br>Form No.                                                                                                                                                                                               | <br>HYDERABAD | <b>PRODUCT STANDARD</b><br><b>BHEL, HYDERABAD -502032.</b><br><b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b> |          |                               |                                                                                      | <b>PY51222</b>                                                                        |                                                                                       |
|                                                                                                                                                                                                                                 |                                                                                                |                                                                                                                 |          |                               |                                                                                      | Rev No. 17                                                                            |                                                                                       |
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|                                                                                                                                                                                                                                 |                                                                                                | Rev. No.                                                                                                        | Date     | Revision Details              | Prepared By                                                                          | Revised By                                                                            | Approved By                                                                           |
|                                                                                                                                                                                                                                 |                                                                                                | 00                                                                                                              | 30.11.15 | FRESH ISSUE                   |    |    |    |
|                                                                                                                                                                                                                                 |                                                                                                | 01                                                                                                              | 27.01.16 | Variant 05 & 06 added         |    |    |    |
|                                                                                                                                                                                                                                 |                                                                                                | 02                                                                                                              | 12.02.16 | Variant 07 & 08 added         |    |    |    |
|                                                                                                                                                                                                                                 |                                                                                                | 03                                                                                                              | 26.02.16 | Variant 09 added              |    |    |    |
|                                                                                                                                                                                                                                 |                                                                                                | 04                                                                                                              | 05.3.16  | Variant 10 added              |    |    |    |
|                                                                                                                                                                                                                                 |                                                                                                | 05                                                                                                              | 07.03.16 | Variant 11 to 13 added        |    |    |    |
|                                                                                                                                                                                                                                 |                                                                                                | 06                                                                                                              | 04.04.16 | Variant 14, 15, 16 & 17 added |    |    |    |
|                                                                                                                                                                                                                                 |                                                                                                | 07                                                                                                              | 05.04.16 | Variant 18 & 19 added         |    |    |    |
|                                                                                                                                                                                                                                 |                                                                                                | 08                                                                                                              | 20.04.16 | Variant 20 added              |   |   |   |
|                                                                                                                                                                                                                                 |                                                                                                | 09                                                                                                              | 28.05.16 | Variant 21 added              |  |  |  |
|                                                                                                                                                                                                                                 |                                                                                                | 10                                                                                                              | 01.06.16 | Variant 22 added              |  |  |  |
|                                                                                                                                                                                                                                 |                                                                                                | 11                                                                                                              | 03.06.16 | Variant 24 added              |  |  |  |
|                                                                                                                                                                                                                                 |                                                                                                | 12                                                                                                              | 05.07.16 | Variant 25 & 26 added         |  |  |  |
|                                                                                                                                                                                                                                 |                                                                                                | 13                                                                                                              | 29.08.16 | Variant 27 & 29 added         |  |  |  |
|                                                                                                                                                                                                                                 |                                                                                                | 14                                                                                                              | 20.09.16 | Variant 30 added              |  |  |  |
|                                                                                                                                                                                                                                 |                                                                                                | 15                                                                                                              | 25.11.16 | Variant 28 & 35 added         |  |  |  |
|                                                                                                                                                                                                                                 |                                                                                                | 16                                                                                                              | 20.06.17 | Variant 40 to 42 added        |  |  |  |
|                                                                                                                                                                                                                                 |                                                                                                | 17                                                                                                              | 27.06.17 | Variant 43 added              |  |  |  |
|                                                                                                                                                                                                                                 |                                                                                                |                                                                                                                 |          |                               |                                                                                      |                                                                                       |                                                                                       |
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| Ref.                                                                                                                                                                                                                            |                                                                                                |                                                                                                                 |          |                               |                                                                                      |                                                                                       |                                                                                       |
| Doc                                                                                                                                                                                                                             |                                                                                                |                                                                                                                 |          |                               |                                                                                      |                                                                                       |                                                                                       |

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| ESP-001-2A<br>Rev.00 |  | <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b> |  | Std. / Doc. Number            |    |
|                      |                                                                                   |                                                   |  | Doc. No. PY-AS-4-M096-8371-01 |    |
|                      |                                                                                   |                                                   |  | Rev. No.                      | 00 |
|                      |                                                                                   |                                                   |  | Sheet 1 of 10                 |    |

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## TECHNICAL SPECIFICATION FOR SCREW SLUDGE LIFTING PUMPS

|          |                          |
|----------|--------------------------|
| PROJECT  | 4.5 MLD STP, BHEL-BHOPAL |
| CUSTOMER | BHEL-BHOPAL              |

| Revisions:00                 |  | Prepared by : | Checked by :                                                                                  | Approved by :                                                                                    | Date :   |
|------------------------------|--|---------------|-----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------|----------|
| Refer to record of revisions |  | RAJEEV JAIN   | <br>GIRISH | <br>M.S.P.B | 27.06.17 |

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**DOCUMENTS TO BE SUBMITTED WITH THE BID:**

The bidder must submit the following documents along with their bid for each Pump, so as to enable BHEL to evaluate their offer.

- a) Duly filled in Pump-Motor datasheet
- b) Tentative GAD for Pump with Motor
- c) Performance curves for pump
- d) Un-priced copy of price in attached BHEL price bid formats indicating quoted/ not quoted against each row & column.
- e) Equipment qualification criteria / PTR / Reference Lists
- f) Checklist as per annexure-4
- g) Deviation list [if any] as per annexure-8

In case the above mentioned documents are not submitted with the offer, the offer of the bidder may be liable for technical rejection.



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### 1.0.0 INTENT OF SPECIFICATION:

This specification specifies the requirement of Design, Engineering, Manufacturing, Assembling, Inspection, testing at manufacturer's works and Delivery of properly packed and painted for transport of Screw Sludge Lifting Pumps with drives and all accessories as specified in the scope of work and as required for the safe and trouble-free operation of equipment to be installed at site.

### 2.0.0 SPECIAL NOTES TO BIDDERS:

**2.0.1** This specification shall be read in conjunction with its enclosures. In case of any discrepancy arising between this specification & its enclosures, the most stringent of all shall be followed and shall over-ride others. Further, if a requirement in this specification or its enclosures, calls for decision of BHEL, it shall be bidder's sole responsibility to clearly bring out the same distinctively in his technical tender offer, so as to enable BHEL to furnish their decision. If such a requirement is not duly addressed by bidder during tender stage and same comes out during order execution stage, it shall be binding on the bidder to comply with the decision furnished by BHEL then, without any cost, delivery, or any other commercial implications.

- a) Bidders shall comply with various requirements of this specification. Bidders can bring out only those deviations which are impractical to meet, for our review.
- b) Bidders may please note that unless the deviations are specifically brought out under deviations clause, it will be considered that no deviations are taken, even if they are mentioned elsewhere directly/indirectly in the offer.

**2.0.2** Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied equipment complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be covered under the scope of this specification.

**2.0.3** The Bidder shall accept full responsibility for the completeness and for the faultless working of all the equipment. These shall be executed on the basis of proven design principle and in accordance with the latest state of the art in such a manner that the purpose to be served by the Pump unit is fulfilled in every respect and a maximum of operational dependability and efficiency are assured. Standardization of equipment, materials etc. shall be employed in the design. Care shall be taken to ensure safe operation as well as simplicity of assembling and dismantling of all parts of the plant.

**2.0.4** Bidder shall quote strictly as per the scope of supply and requirements of this specification.

**2.0.5** Bidder offer shall be strictly as per these specification requirements. Unsolicited or Alternate offers from the bidders will not be entertained.

**2.0.6** In case bidder feels that it is necessary to exclude some components of scope of supply or some of the features of specification requirements due to any technical constraints, bidder shall bring the same to the notice of purchaser during pre-bid stage and take their prior approval before submission of their bid.

**2.0.7** Incase Bidder is unable to offer due to any specific requirement of specification. Bidder shall bring out the same in their regret letter. Otherwise it will be considered that non participation by the bidder is attributable to reasons other than any specification requirements.

### 3.0.0 APPLICATION OF SYSTEM:

2 Nos. [1 Working+1Standby] of Screw Sludge Lifting Pumps is envisaged for feeding Sewage from Sludge Sump to Centrifuge for mechanical dewatering.

**4.0.0 TECHNICAL DETAILS/REQUIREMENTS:****Design Parameters and Technical Requirement of Screw Sludge Lifting Pumps with drives:**

| Sl. No. | Description                                 | Unit               | Rated Condition                                                                                                                                                                                                                                                                                      |
|---------|---------------------------------------------|--------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | Temperature of Fluid                        | Deg. C             | Ambient                                                                                                                                                                                                                                                                                              |
| 2 a)    | Sludge Quality                              |                    | Refer Annexure-1                                                                                                                                                                                                                                                                                     |
| b)      | Specific Gravity                            |                    | 1 kg/m <sup>3</sup>                                                                                                                                                                                                                                                                                  |
| c)      | Solid Size                                  |                    | 80 mm(Soft)                                                                                                                                                                                                                                                                                          |
| 3       | Capacity Of each pump                       | m <sup>3</sup> /hr | 8                                                                                                                                                                                                                                                                                                    |
| 4       | Pump Differential Head(At Discharge Flange) | mwc                | 10                                                                                                                                                                                                                                                                                                   |
| 5       | Quantity Required                           | Nos.               | 2 Nos.[1W+1S]                                                                                                                                                                                                                                                                                        |
| 6       | Drive(Pump Supplier Scope)                  |                    | Motor<br>[Energy Efficient Class:IE3 as per IS 12615]                                                                                                                                                                                                                                                |
| 7       | Pump Type                                   |                    | Positive displacement type Screw Pump(Progressive cavity Pump-Horizontal)                                                                                                                                                                                                                            |
| 8       | Application                                 |                    | Feeding Sewage Sludge from Sludge Sump to Centrifuge                                                                                                                                                                                                                                                 |
| 9       | Duty                                        |                    | Continuous                                                                                                                                                                                                                                                                                           |
| 10      | Power Supply                                |                    | 3 Ph,415 V,+/- 10% Voltage Variation, 50Hz,+/- 5% Frequency variation, Combined: +/- 10% , DOL Starting                                                                                                                                                                                              |
| 11      | Material of Construction                    |                    | Casing: CI, Impeller: CI/SS, Shaft: SS, Sleeve: SS316, Wear Ring: CI/Bronze/SS, Mechanical Seal: Silicon Carbide, Other Components as per Manufacturer standard.<br>* In case bidder can't meet above mentioned material, Bidder can offer Equivalent/Superior material suitable to the requirement. |

**5.0.0 SCOPE OF SUPPLY:**

The scope of supply for this enquiry is as given below:

Please refer to the enclosed Schematic for Screw Sludge Lifting Pumps (Annexure-1) for general clarity on scope of supply. The system shall be provided as per annexure-1 taking into all requirements including for testing, painting, documentation, sub vendor list, equipment specifications etc., specified in this specification and enclosures.

**Quantity of Pump & Drive Assembly:**

2 Nos.(1W+1S) of Screw Sludge Lifting Pumps

The scope of supply for each pump & motor drive assembly is as given:

**5.1.0 Pump:**

Positive displacement type Screw Pump (Progressive cavity Pump-Horizontal) complete with all accessories as per specification & required accessories for smooth running of pump assembly. Performance requirement, Design and construction of the pump shall be guided by the Manufacturer recommendation.

**5.2.0 Motor:**

Motor shall be as per IS 325/IEC60034.  
Energy Efficient Class: IE 3 as per IS 12615.  
For Motor, Supply voltage is 415 V.

**5.3.0 Coupling between pump and motor :**

Coupling between pump and motor shall comply with the following.

- a) Coupling shall be as per as per manufacturer's standard
- b) Metallic, Non-lubricated, flexible element type [diaphragm or disc type],
- c) With Non sparking type coupling guard
- d) With spacer
- e) With a minimum service factor of 1.5

**5.4.0 Type of Sealing: Mechanical Seal****5.5.0 Relief Valve at outlet of Pump-1 No./Pump****5.6.0 Inter connecting Piping & Instrumentation:****For BHEL Pipe Size: Refer Annexure-1**

Reducer/expander, Flanges & Counter flanges with necessary gaskets & bolts at all terminal points as per annexure-1.  
All counter flanges shall be of weld neck type. Suction Reducer/expander shall be eccentric type.

Flanges: ASTM A234 Gr. WPB or ASTM A105 or equivalent.

Fittings: The material shall conform to ASTM A234 Gr. WPB or ASTM A105 or equivalent and dimensional standard conforming to ANSI B 16.9 (socket & threaded type), ANSI B 16.22 (for flanges and flanged fittings).

The fittings shall be galvanized as per IS: 4736 for galvanized pipe application.

**5.7.0 Necessary foundation bolts, nuts, shims/grouting pads etc.****5.8.0 Instrumentation:** Bidder to consider required instrumentation, which are required for smooth & trouble free operation as per manufacturer recommendation.**5.9.0 All** other items necessary for safe and smooth running of pump & Accessories required to make the supplied equipment complete in all respect.**5.10.0** Glands and lugs for power cable, control cable, Space heater cable and earthing cable (if any) suitable at Motor end has to be supplied along with the main equipment. Glands shall be Flame proof/weather proof (as per motor category) double compression type Nickel plated Brass (ET) shall be provided with back nut and PVC shroud. Lugs shall be tinned copper heavy duty lug Cable dimensions shall be furnished during detail engineering, accordingly glands, lugs shall be supplied.**5.11.0 Commissioning Spares:****For Screw Sludge Lifting Pumps(Positive displacement type Screw Pump(Progressive cavity Pump-Horizontal):**

Two sets (One set for each pump & motor assembly) of commissioning spares for Screw Sludge Lifting Pumps Positive displacement type Screw Pump(Progressive cavity Pump-Horizontal) shall be quoted and included in scope of supply as per manufacturer's recommendation.

**5.12.0 Mandatory Spares: Not Applicable.****5.13.0 Special Tools and Tackles:**

For Screw Sludge Lifting Pumps (Positive displacement type Screw Pump (Horizontal):

The bidder shall furnish a complete 2 sets [1 set each for Each pump] of all special tools, wrenches etc. with necessary





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tools boxes as required for operation and maintenance [disassemble, assemble, or maintaining the unit] as a part of scope of supply. **Bidder shall furnish a list of such tools along with offer for the system.** Prices for the special tools and tackles shall be part of main scope of supply. No separate price shall be offered for the same.

### 6.0.0 OPTIONAL PRICES: Please Refer to Attached Price Bid Format.

Bidder to furnish the following as optional prices:

- 1) 2 year recommended spares for each pump

### 7.0.0 EQUIPMENT QUALIFICATION CRITERIA (EQC)

The bidder shall be an established manufacturer of Positive displacement type Screw Pump (Progressive cavity Pump-Horizontal) & having adequate engineering, manufacturing & testing facilities for Positive displacement type Screw Pump (Progressive cavity Pump-Horizontal) confirming to the relevant applicable codes and standards. The Positive displacement type Screw Pump (Progressive cavity Pump-Horizontal) model offered shall be from the existing regular manufacturing range of bidder.

The offered Positive displacement type Screw Pump(Progressive cavity Pump-Horizontal) model shall meet the minimum service & manufacturing experience specified as below:

Positive displacement type Screw Pump(Progressive cavity Pump-Horizontal) shall be identical or validly similar in terms of

- Type i.e. Submersible Pump
- Capacity/Flow Rate
- Materials etc.
- Application.

as compared to at least 10 Units of the proposed model designed, manufactured, tested and supplied from the proposed manufacturing plant in the last 7(seven) years from the date of Technical bid opening and at least Five of these units shall have successfully operated in the field for at least 8000 hours individually without any major problem as on the date of issue of enquiry in the last three years. As a proof for the same, Date of Supply/ Commissioning report/Customer Satisfaction report will be considered and same to be provided by vendor.

Accordingly, Bidder to furnish reference list for the Positive displacement type Screw Pump (Progressive cavity Pump-Horizontal) consisting of year of supply, application, Customer Name, Quantity etc. as a minimum.

### 8.0.0 QUALITY PLAN & INSPECTION AGENCY & TESTING:

#### Quality Plan: Pls refer annexure-5 for typical quality plan.

Bidder to furnish Quality Plan to BHEL for approval after award of contract. Quality plan will be reviewed during detailed Engineering stage with respect to Inspection, standard Engineering practices & Specification Requirements and various tests and stages of inspection and appropriate agencies for Inspection will be Intimated. Bidder to abide by the same.

#### Inspection agency:

BHEL/Third Party appointed by BHEL. The various review/witness/observation stages by Individual agencies (or) Group of Agencies as above will be in line with approved quality plan.

Performance test: Bidder to conduct performance test as per applicable test standard as a minimum.

Material Test Report: Material test report to be furnished for BHEL review.

### 9.0.0 PAINTING:

As per Manufacturer standard practice. However standard quality paint to be used.

### 10.0.0 PACKING AND FORWARDING:

As per Manufacturer Standard Practice. (Domestic Packing/Sea worthy packing in case of Import)

### 11.0.0 SUB VENDORS:

#### Motor:

|                            |
|----------------------------|
| SIEMENS INDIA LTD SECBAD.  |
| GE T&D INDIA LIMITED       |
| ABB INDIA LIMITED, HYD     |
| KIRLOSKAR ELEC.CO.LTD      |
| LAXMI HYDRAULICS PVT. LTD. |



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BHARAT BIJLEE LTD, MUMBAI

CROMPTON GREAVES

**Signal Cable:**

a) Cord Cable, b) Udey Pyrocable, c) Special Cables &amp; d) Thermocables.

**Cable Glands:**

a) Electromeg, b) CCI, c) Dowels, d) Metal Crafts Industries, Rajkot,

**Cable Lugs:**

a) Phoneix, b) Dowells &amp; c) Hex

**LT Power Cable & Control Cable:**

Polycab / apar industries / special cables / universal / RPG / KEI, Bhiwadi/ Havells / Skytone / Laser cables / Gems cab / Sbee cables / v-guard industries/ CCI / Cords/ General cable india / TBEA china / New Baofeng china / Far east china / Gupta power ltd.

Bidder shall follow approved sub vendors list. In case of any specific practical difficulty, bidder is requested to bring out the same with proper reason for not following vendor list. For other items for which sub vendors are not specified, bidder can follow their standard vendors. However, they have to ensure the Proven Track record of the sub vendors and Bidder to take prior approval of BHEL for the same.

**12.0.0 DOCUMENTATION:**

a) Documentation shall be submitted by bidder during detailed engineering stage, as per the Master Document List to be mutually finalized during detailed engineering stage.

b) No. of Copies to be furnished :

All the documents shall be submitted as given below:

| S.N. | DESCRIPTION                                                                      | No. of copies to be Provided | WHEN TO SUBMIT                                                                                                                                                   |
|------|----------------------------------------------------------------------------------|------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1    | Initial drawings/documents under approval and information category.              | 1                            | Within 2 weeks of placement of order                                                                                                                             |
| 2    | Revised drawings/documents incorporating BHEL's comments.                        | 1                            | Within 1 week of receipt of commented Drawings from BHEL                                                                                                         |
| 3    | Final Drawings/documents                                                         | 4                            | Within 2 months of placement of order.                                                                                                                           |
| 4    | Erection Documentation                                                           | 5                            | <del>2 Months before dispatch of equipment. The list of documents identified under master document list for erection to be furnished in 5 nos. of folders.</del> |
| 5    | Draft O & M Manuals with out test certificates (if felt necessary)               | 1                            | 2 months before the delivery date of equipment                                                                                                                   |
| 6    | Revised O & M Manuals with Test Certificates to be submitted to BHEL (Hyderabad) | 4                            | Within one month after dispatch of equipment                                                                                                                     |



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|   |                           |   |                                              |
|---|---------------------------|---|----------------------------------------------|
| 7 | Final O&M Manuals in a CD | 3 | Within one month after dispatch of equipment |
|---|---------------------------|---|----------------------------------------------|

Following drawings to be submitted for BHEL approval:

- i) GA drawing, Datasheet, Cross sectional drawing, Performance Curves for Pump & Motor
- ii) GA drawing, wiring diagram of Pump Assembly

### 13.0.0 PRICE BID FORMAT:

Bidder to indicate his offer as per Price Bid format enclosed as Annexure-3.

All the items included in the price bid format shall be quoted as per tender specification and pre-bid clarifications as per annexure-7, if any. Responsibility of ensuring correctness & completeness of scope of supply as per specification requirement solely lies with bidder.

The equipment supplied shall be complete in all respects. The bidder shall not be eligible for any extra payment in respect of such mountings, fittings, fixtures and accessories if required for the safe and reliable operation of the equipment. Any additional equipment, material, etc., which are not specifically mentioned here, but are required to make the supplied equipment complete in all respect, in accordance with the intent of this technical specification, contractual agreement, statutory requirements, relevant/applicable codes/standards, good engineering practices, and for safe and trouble-free operation, shall be deemed to be in bidder scope Only.

Main offer consists of those items which will be part of main order after successful bidder is identified. Optional Items consists of those items which need to be quoted by bidder but may or may not be ordered by BHEL. Bidders are instructed to provide the pricing details listed under Main offer and Optional items as per the prescribed format. Prices quoted by the bidder shall remain firm till the successful handing over of the entire package to end customer. Any request for upward revision of price during any intermediate stage before handing over the plant to end customer will be summarily rejected by BHEL.

The Priced Bid shall be submitted in Original (without any copy) duly signed and stamped on each page in a separate sealed envelope super scribing "Price Bid –Do not Open" This shall not contain any condition whatsoever failing which the Bids shall be liable to be rejected. In case of any correction, the bidder shall put its signature and its stamp. Eraser fluid will not be allowed for making any correction.

Bidder shall confirm to the un-priced bid as part of their offer.

### 14.0.0 PRE-BID CLARIFICATIONS & DEVIATIONS:

14.1.0 Bidders shall comply with various requirements of this specification. It may please be noted that the requirements specified here in this specification are the standard practices being followed by the bidders. However, same things are presented in a structured form so that it can be ensured that the requirements of ultimate customer are complied with.

14.2.0 Bidders can bring out only those deviations which are impractical to meet, for our review in pre bid clarification only.

14.3.0 Bidders may also please note that the data sheets for, valves, instruments etc., submitted along with the offer will be considered as indicative only, as the requirements specified in the specification are standard in nature. These will not be reviewed by BHEL before award of contract. Same will be reviewed during order execution stage in line with the requirements of specification and agreed deviations.

14.4.0 All pre-bid clarifications & deviations shall be clear bring as per annexure- 7 & 8 Only.

14.5.0 In case bidder doesn't bring any clarification/deviation in prebid stage, the same shall be brought in their offer with following conditions:

- a) Any deviations to Customer specifications, same are acceptable provided these deviations are also regularly accepted by Customer for their direct orders on bidders. During detailed engineering stage if it is found that any deviation brought out by bidder is not a regular deviation accepted by Customer, the particular deviation brought out by bidder will not be considered as an acceptable deviation.
- b) Bidders may please note that unless the deviations are specifically brought out under deviations clause, it will be considered that no deviations are taken, even if they are mentioned elsewhere directly/indirectly in the offer.
- c) Price implication due to non-acceptance [by BHEL/Customer] of the deviations asked by bidder shall not be acceptable by BHEL.

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**15.0.0 ANNEXURES:**

Following input documents and specifications are enclosed to facilitate the bidder to furnish the offer and ensure compliance:

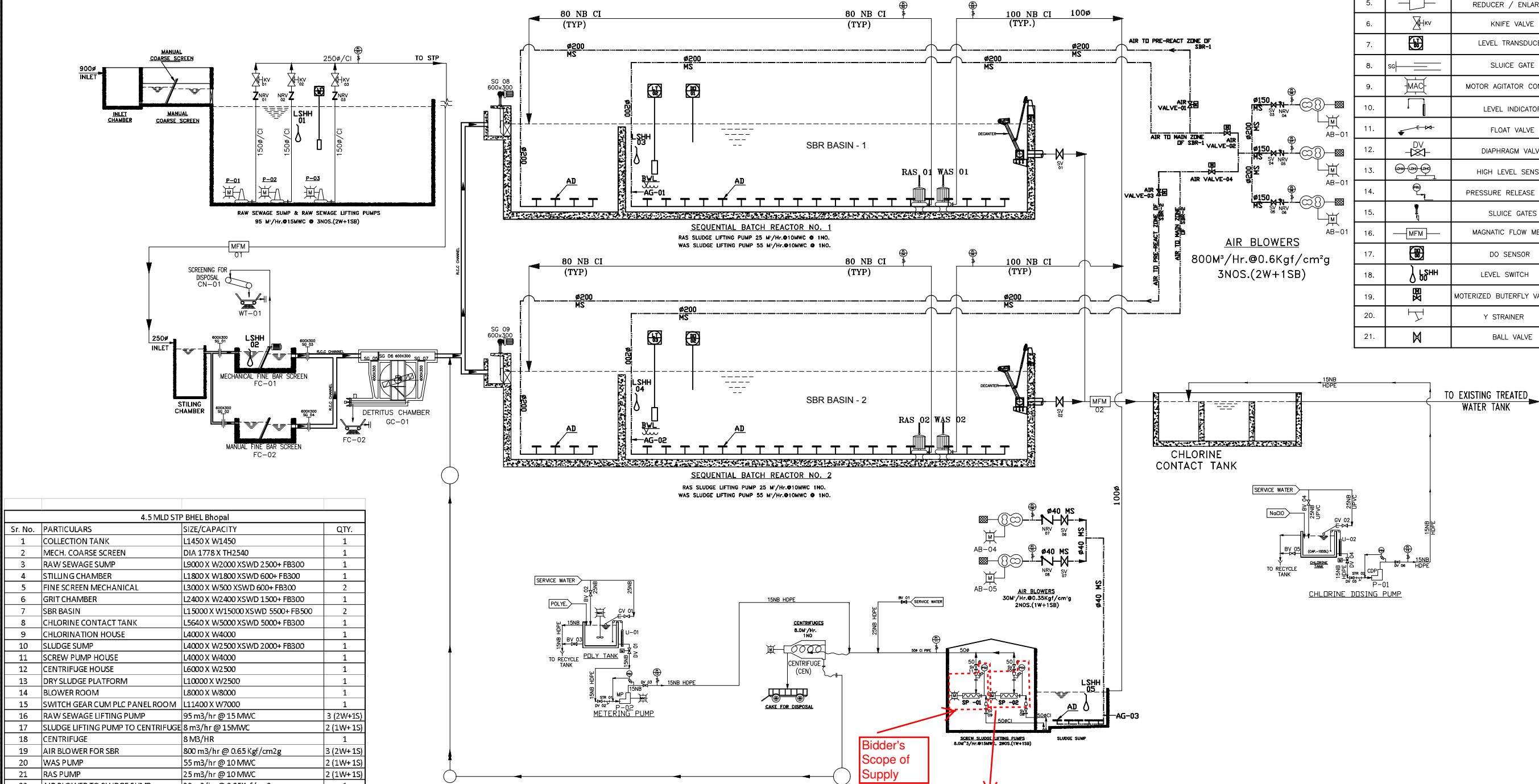
| Annexure No. | Description                                  |
|--------------|----------------------------------------------|
| 01           | Schematic For Pump-Drive Assembly            |
| 02           | Pump-Motor Data Sheet                        |
| 03           | Price Bid Format                             |
| 04           | Check List                                   |
| 05           | QAP guide Line & Formats                     |
| 06           | BOM Standard Format & Master DOC List Format |
| 07           | Pre-bid clarification format                 |
| 08           | Deviation format                             |

M SIVA  
PRASAD BABU

|                      |                                                                                   |                                                   |                                             |    |
|----------------------|-----------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------|----|
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|                      |                                                                                   |                                                   | Annexure-1 to Doc. No. PY-AS-4-M096-8371-01 |    |
|                      |                                                                                   |                                                   | Rev. No.                                    | 00 |
|                      |                                                                                   |                                                   |                                             |    |

|                                                                                                                                                                                                                                                |                                                                     |  |  |  |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|--|--|--|
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|                                                                                                                                                                                                                                                |                                                                     |  |  |  |

|                                                   |                      |                     |                      |               |
|---------------------------------------------------|----------------------|---------------------|----------------------|---------------|
| <b>Revisions:</b><br>Refer to record of revisions | <b>Prepared by :</b> | <b>Checked by :</b> | <b>Approved by :</b> | <b>Date :</b> |
|                                                   | Rajeev Jain          | GIRISH              | Siva Prasad Babu     | 27.06.17      |



| 4.5 MLD STP BHEL Bhopal |                                   |                                                    |           |
|-------------------------|-----------------------------------|----------------------------------------------------|-----------|
| Sr. No.                 | PARTICULARS                       | SIZE/CAPACITY                                      | QTY.      |
| 1                       | COLLECTION TANK                   | L1450 X W1450                                      | 1         |
| 2                       | MECH. COARSE SCREEN               | DIA 1778 X TH2540                                  | 1         |
| 3                       | RAW SEWAGE SUMP                   | L9000 X W2000 XSWD 2500+ FB300                     | 1         |
| 4                       | STILLING CHAMBER                  | L1800 X W1800 XSWD 600+ FB300                      | 1         |
| 5                       | FINE SCREEN MECHANICAL            | L3000 X W500 XSWD 600+ FB300                       | 2         |
| 6                       | GRIT CHAMBER                      | L2400 X W2400 XSWD 1500+ FB300                     | 1         |
| 7                       | SBR BASIN                         | L15000 X W15000 XSWD 5500+ FB500                   | 2         |
| 8                       | CHLORINE CONTACT TANK             | L5640 X W5000 XSWD 5000+ FB300                     | 1         |
| 9                       | CHLORINATION HOUSE                | L4000 X W4000                                      | 1         |
| 10                      | SLUDGE SUMP                       | L4000 X W2500 XSWD 2000+ FB300                     | 1         |
| 11                      | SCREW PUMP HOUSE                  | L4000 X W4000                                      | 1         |
| 12                      | CENTRIFUGE HOUSE                  | L6000 X W2500                                      | 1         |
| 13                      | DRY SLUDGE PLATFORM               | L10000 X W2500                                     | 1         |
| 14                      | BLOWER ROOM                       | L8000 X W8000                                      | 1         |
| 15                      | SWITCH GEAR CUM PLC PANEL ROOM    | L11400 X W7000                                     | 1         |
| 16                      | RAW SEWAGE LIFTING PUMP           | 95 m <sup>3</sup> /hr @ 15 MWC                     | 3 (2W+1S) |
| 17                      | SLUDGE LIFTING PUMP TO CENTRIFUGE | 8 m <sup>3</sup> /hr @ 15 MWC                      | 2 (1W+1S) |
| 18                      | CENTRIFUGE                        | 8 M <sup>3</sup> /HR                               | 1         |
| 19                      | AIR BLOWER FOR SBR                | 800 m <sup>3</sup> /hr @ 0.65 Kg/cm <sup>2</sup> g | 3 (2W+1S) |
| 20                      | WAS PUMP                          | 55 m <sup>3</sup> /hr @ 10 MWC                     | 2 (1W+1S) |
| 21                      | RAS PUMP                          | 25 m <sup>3</sup> /hr @ 10 MWC                     | 2 (1W+1S) |
| 22                      | AIR BLOWER TO SLUDGE SUMP         | 30 m <sup>3</sup> /hr @ 0.35 Kg/cm <sup>2</sup> g  | 1         |
| 23                      | POLYELECTROLYTE SOLUTION TANK     | 3350 LITER                                         | 1         |
| 24                      | METERING PUMP                     | 335 LPH                                            | 1         |
| 25                      | CHLORINE DOZING PUMP              | 125 LPH                                            | 1         |
| 26                      | NaClO STORAGE TANK                | 1000 LITER                                         | 2         |

|     |          |                   |    |                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                          |  |                                          |  |                                     |                                  |                           |                                |       |                        |                                               |  |
|-----|----------|-------------------|----|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|--|------------------------------------------|--|-------------------------------------|----------------------------------|---------------------------|--------------------------------|-------|------------------------|-----------------------------------------------|--|
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| R2  | 01.06.17 | REVISE AS COMMENT |    |                                                                                                                                                                                                                                                                                                                                                                                                                                 | PREPARED BY: SHRIKANT                                                    |  | DATE: <div>27.05.17</div>                |  | REFERENCE DRAWING:                  |                                  |                           | SCALE: <div>NOT TO SCALE</div> |       | REVISION: <div>0</div> |                                               |  |
| R1  | 27.05.17 | REVISE AS COMMENT |    |                                                                                                                                                                                                                                                                                                                                                                                                                                 | CLIENT: <div>BHEL-HYDEREBAD</div>                                        |  | VERIFIED BY: <div>B. N SEN</div>         |  | DATE: <div>27.05.17</div>           |                                  | VERIFIED BY:              |                                | DATE: |                        | DRAWING NUMBER: <div>T6982017- P&amp;ID</div> |  |
| NO. | DATE     | REVISION          | BY |                                                                                                                                                                                                                                                                                                                                                                                                                                 | APPROVED BY: <div>VARSHA SINGH</div>                                     |  | DATE: <div>27.05.17</div>                |  | DRAWING BY: <div>DIPEN SARKAR</div> |                                  | DATE: <div>27.05.17</div> |                                |       |                        |                                               |  |
|     |          |                   |    |                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                          |  |                                          |  |                                     |                                  |                           |                                |       |                        |                                               |  |

|     |          |                   |    |
|-----|----------|-------------------|----|
| R2  | 01.06.17 | REVISE AS COMMENT |    |
| R1  | 27.05.17 | REVISE AS COMMENT |    |
| NO. | DATE     | REVISION          | BY |

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## D SECONDARY OR BIOLOGICAL TREATMENT

### D.1 SEQUANCING BATCH REACTOR

#### **Influent - Raw**

|            |          |
|------------|----------|
| <b>BOD</b> | 188 mg/L |
| <b>TSS</b> | 274 mg/L |

#### **Influent - SBR**

|                                            |                        |
|--------------------------------------------|------------------------|
| <b>Flow</b>                                | 4500 m <sup>3</sup> /d |
| <b>Hourly Peak Flow</b>                    | 5400 m <sup>3</sup> /d |
| <b>BOD</b>                                 | 188 mg/L               |
| <b>COD</b>                                 | 516 mg/L               |
| <b>TSS</b>                                 | 274 mg/L               |
| <b>VSS/TSS</b>                             | 0.80                   |
| <b>VSS</b>                                 | 219.2 mg/L             |
| <b>TKN</b>                                 | 30 mg/L                |
| <b>Ammonification limits</b>               | 100%                   |
| <b>Ammonified TKN</b>                      | 30 mg/L                |
| <b>TP</b>                                  | 5 mg/L                 |
| <b>Alkalinity (as CaCO<sub>3</sub>)</b>    | 264.2 mg/L             |
| <b>bCOD/BOD</b>                            | 1.6 kgbCOD/kgBOD       |
| <b>COD/BOD</b>                             | 2.7 kgCOD/kgBOD        |
| <b>Elevation of site to mean sea level</b> | 527 m                  |

#### **Temperature**

|                                          |         |
|------------------------------------------|---------|
| <b>Wastewater temperature for design</b> | 20 degC |
| <b>maximum temp</b>                      | 30 degC |

#### **Effluent**

|                                  |         |
|----------------------------------|---------|
| <b>BOD effluent</b>              | 10 mg/L |
| <b>SS effluent</b>               | 10 mg/L |
| <b>NH<sub>4</sub>-N effluent</b> | 5 mg/L  |
| <b>TP effluent</b>               | 2 mg/L  |



|                                                  |                                 |
|--------------------------------------------------|---------------------------------|
| <b>TN effluent</b>                               | 10 mg/L                         |
| <b>Design parameters</b>                         |                                 |
| <b>MLSS</b>                                      | 4500 mg/L                       |
| <b>Number of tanks</b>                           | 2                               |
| <b>HRT</b>                                       | 0.55 d                          |
| <b>Reactor Sizing (including pre-react zone)</b> |                                 |
| <b>Surface area per Reactor</b>                  | 225.0 m <sup>2</sup>            |
| <b>Length</b>                                    | 15.00 m.                        |
| <b>Width</b>                                     | 15.00 m.                        |
| <b>Maximum Liquid depth</b>                      | 5.50 m.                         |
| <b>Free board</b>                                | 0.50 m.                         |
| <b>Top of the wall</b>                           | 6.00 m.                         |
| <b>Cycle</b>                                     |                                 |
| <b>Number of cycles / tank . d</b>               | 4.00                            |
| <b>Total number of cycles / d</b>                | 8.00                            |
| <b>Aeration hours per day</b>                    | 12.00 hrs.                      |
| <b><u>OPERATIONAL PARAMETERS</u></b>             |                                 |
| <b>MLSS</b>                                      | 4500 mg/L                       |
| <b>MLVSS</b>                                     | 3219 mg/L                       |
| <b>Sludge Retention Time, SRT</b>                | 11 day                          |
| <b>Observed yield</b>                            | 1.24 kgTSS / kgBOD              |
| <b>F/M (BOD<sub>5</sub>/MLSS)</b>                | 0.08 kg / kg • d                |
| <b>BOD<sub>5</sub> volumetric loading</b>        | 0.34 kg / m <sup>3</sup> • d    |
| <b>BOD<sub>5</sub> volumetric loading</b>        | 21 lb /1000 ft <sup>3</sup> • d |
| <b><u>WAS</u></b>                                |                                 |
| <b>Total Sludge production</b>                   | 1045 kg TSS/d                   |
| <b>TSS load in the supernatant (effluent)</b>    | 45.0 kg/d                       |
| <b>Net sludge production</b>                     | 1000 kg/d                       |

|                                    |                          |
|------------------------------------|--------------------------|
| <b>WAS concentration</b>           | 8325 mg/L                |
| <b>Total WAS volume per day</b>    | 120 m <sup>3</sup> /d    |
| <b>Number of WAS pumps per SBR</b> | 1                        |
| <b>WAS pump capacity</b>           | 0.86 m <sup>3</sup> /min |
| <b>WAS pumping time</b>            | 17.46 min/cycle          |

### **RAS**

|                                    |                          |
|------------------------------------|--------------------------|
| <b>Number of RAS pumps per SBR</b> | 1                        |
| <b>RAS pump capacity</b>           | 0.39 m <sup>3</sup> /min |
| <b>RAS pumping time</b>            | 3.0 h                    |

### **Aeration**

|                                                     |                           |
|-----------------------------------------------------|---------------------------|
| <b>O<sub>2</sub> for BOD t removed</b>              | 1.1 kg/kg                 |
| <b>Nitrification of TKN*</b>                        | 79%                       |
| <b>O<sub>2</sub> for N nitrified</b>                | 4.57 kg/kg                |
| <b>O<sub>2</sub> for N denitrified</b>              | 2.90 kg/kg                |
| <b>AOR for BOD t removed</b>                        | 880 kg O <sub>2</sub> /d  |
| <b>AOR for TKN t nitrified</b>                      | 383 kg O <sub>2</sub> /d  |
| <b>Oxygen credit for denitrification</b>            | 137 kg O <sub>2</sub> /d  |
| <b>AOR t r</b>                                      | 1127 kg O <sub>2</sub> /d |
| <b>AOR t r / hour</b>                               | 47 kg O <sub>2</sub> /h   |
| <b>Corrected average depth</b>                      | 4.94 m                    |
| <b>β salinity surface tension correction factor</b> | 0.98                      |
| <b>Alpha</b>                                        | 0.60                      |
| <b>AOR/SOR</b>                                      | 0.45 ratio                |
| <b>SOR t</b>                                        | 2526 kg/d                 |
| <b>SOR total / Cycle</b>                            | 105.2 kg/h                |
| <b>Oxygen peak factor</b>                           | 1.0                       |
| <b>Fine bubble aeration</b>                         |                           |
| <b>Diffuser type</b>                                | 1m                        |
| <b>Membrane diffusers loading</b>                   | 10 scfm/diff.             |
| <b>Diffuser height from bottom</b>                  | 0.20 m                    |
| <b>Average submergence DWD</b>                      | 4.74 m                    |
| <b>% O<sub>2</sub> transf.</b>                      | 2.0 %/ft                  |

|                                         |                          |
|-----------------------------------------|--------------------------|
| <b>% O<sub>2</sub> transfer</b>         | 31 %                     |
| <b>Air requirement / SBR</b>            | 718 scfm                 |
| <b>No diff./react.</b>                  | 72 diff.                 |
| <b><u>Blowers</u></b>                   |                          |
| <b>No. of blowers / per pair of SBR</b> | 2 units                  |
| <b>Capacity</b>                         | 360 scfm                 |
| <b>Capacity</b>                         | 10.2 m <sup>3</sup> /min |
| <b>Relative humidity</b>                | 95%                      |
| <b>Extreme air temperature</b>          | 45 oC                    |
| <b>Capacity at inlet conditions</b>     | 463 acfm                 |
| <b>Capacity at inlet conditions</b>     | 13.1 m <sup>3</sup> /min |
| <b>Diffuser height from tank bottom</b> | 0.2 m                    |
| <b>Diffuser headloss</b>                | 0.65 psi                 |
| <b>Air piping headloss</b>              | 1.5 psi                  |
| <b>Water column at design flow</b>      | 7.5 psi                  |
| <b>Design over pressure</b>             | 0.5 psi                  |
| <b>Blower discharge pressure</b>        | 10.18 psi                |
| <b>Blower mechanical efficiency</b>     | 0.70                     |
| <b>Brake horse power</b>                | 26.89 BHP                |

**Maximum Particle Size at inlet of Screw Pump: 80 mm**

|                      |                                                                                   |                                                   |                                             |    |
|----------------------|-----------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------|----|
| ESP-001-2A<br>Rev.00 |  | <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b> | Std. / Doc. Number                          |    |
|                      |                                                                                   |                                                   | Annexure-2 to Doc. No. PY-AS-4-M096-8371-01 |    |
|                      |                                                                                   |                                                   | Rev. No.                                    | 00 |
|                      |                                                                                   |                                                   |                                             |    |

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|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|

| Revisions:                   | Prepared by : | Checked by : | Approved by :    | Date :   |
|------------------------------|---------------|--------------|------------------|----------|
| Refer to record of revisions | Rajeev Jain   | GIRISH       | Siva Prasad Babu | 27.06.17 |

**CUSTOMER: BHEL BHOPAL**  
**PROJECT: 4.5MLD STP PROJECT, BHEL-BHOPAL**

| DATA SHEET FOR SCREW SLUDGE LIFTING PUMP    |                                                                                                                                                                                                                                                                                                                                               |                                                                                                       |         |
|---------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|---------|
| Sl.no.                                      | Description                                                                                                                                                                                                                                                                                                                                   | BHEL Requirement                                                                                      | DETAILS |
| <b>GENERAL DATA</b>                         |                                                                                                                                                                                                                                                                                                                                               |                                                                                                       |         |
| 1                                           | Service                                                                                                                                                                                                                                                                                                                                       | Feeding Sewage Sludge from Sludge Sump to Centrifuge                                                  |         |
| 2                                           | Number of Pumps                                                                                                                                                                                                                                                                                                                               | Total : 2 Nos.[2 W+1S]                                                                                |         |
| 3                                           | Location                                                                                                                                                                                                                                                                                                                                      | Outdoor                                                                                               |         |
| 4                                           | Duty                                                                                                                                                                                                                                                                                                                                          | Continuous                                                                                            |         |
| 5                                           | Drives                                                                                                                                                                                                                                                                                                                                        | Motor                                                                                                 |         |
| 6                                           | Pumping fluid                                                                                                                                                                                                                                                                                                                                 | Sewage Sludge[For Sludge Details Refer Annexure-1]                                                    |         |
| 7                                           | Fluid temp Deg C                                                                                                                                                                                                                                                                                                                              | Ambient                                                                                               |         |
| <b>PUMP PERFORMANCE &amp; OTHER DETAILS</b> |                                                                                                                                                                                                                                                                                                                                               |                                                                                                       |         |
| 8                                           | Pump Type                                                                                                                                                                                                                                                                                                                                     | Positive displacement type Screw Pump(Horizontal)                                                     |         |
| 9                                           | Design Standard of pump                                                                                                                                                                                                                                                                                                                       | To be mentioned by Bidder                                                                             |         |
| 10                                          | Rated Flow (m <sup>3</sup> /hr)                                                                                                                                                                                                                                                                                                               | 8                                                                                                     |         |
| 11                                          | Rated Differential Head (mlc)                                                                                                                                                                                                                                                                                                                 | 10                                                                                                    |         |
| 12                                          | Pump Model No.                                                                                                                                                                                                                                                                                                                                | To be mentioned by Bidder                                                                             |         |
| 13                                          | No. of Stages of pump                                                                                                                                                                                                                                                                                                                         | To be mentioned by Bidder                                                                             |         |
| 14                                          | Parallel operation                                                                                                                                                                                                                                                                                                                            | No                                                                                                    |         |
| 15                                          | Rated Speed of Pump (rpm)                                                                                                                                                                                                                                                                                                                     | To be mentioned by Bidder                                                                             |         |
| 16                                          | Rated speed of Motor (rpm)                                                                                                                                                                                                                                                                                                                    | To be mentioned by Bidder                                                                             |         |
| 17                                          | Pump Efficiency in %                                                                                                                                                                                                                                                                                                                          | To be mentioned by Bidder                                                                             |         |
| 18                                          | Available Pressure at centre line of Suction nozzle of Pump mlc                                                                                                                                                                                                                                                                               | Min. 1.0 kg/cm <sup>2</sup>                                                                           |         |
| 19                                          | NPSH(A) at pump suction nozzle (mlc)                                                                                                                                                                                                                                                                                                          | Flooded                                                                                               |         |
| 20                                          | NPSH(R) (mlc)                                                                                                                                                                                                                                                                                                                                 | To be mentioned by Bidder                                                                             |         |
| 21                                          | NPSH(A) - NPSH(R)                                                                                                                                                                                                                                                                                                                             | Minimum 1 m of margin between NPSH(A) & NPSH(R) to be maintained.                                     |         |
| 22                                          | Pump shut off head.                                                                                                                                                                                                                                                                                                                           | Flow vs Head curve shall be continuously rising towards shut-off head.                                |         |
| 23                                          | Pump shut off head/rated head.                                                                                                                                                                                                                                                                                                                | To be mentioned by Bidder                                                                             |         |
| 25                                          | Impller type                                                                                                                                                                                                                                                                                                                                  | As per Manufacturer Recommendation                                                                    |         |
| 26                                          | Pump rated impeller dia. mm                                                                                                                                                                                                                                                                                                                   | To be mentioned by Bidder                                                                             |         |
| 27                                          | Pump max. impeller dia. mm                                                                                                                                                                                                                                                                                                                    | To be mentioned by Bidder                                                                             |         |
| 28                                          | Pump minimum impeller dia., mm                                                                                                                                                                                                                                                                                                                | To be mentioned by Bidder                                                                             |         |
| <b>PUMP CONSTRUCTION FEATURES</b>           |                                                                                                                                                                                                                                                                                                                                               |                                                                                                       |         |
| 29                                          | Material of Construction:<br>Casing: CI, Impeller: CI/SS,<br>Shaft: SS, Sleeve: SS316,<br>Wear Ring: CI/Bronze/SS,<br>Mechanical Seal: Silicon Carbide,<br>Other Components as per Manufacturer standard.<br>* In case bidder can't meet above mentioned material, Bidder can offer Equivalent/Superior material suitable to the requirement. | To be Confirmed by Bidder                                                                             |         |
| 30                                          | Sealing arrangement                                                                                                                                                                                                                                                                                                                           | Mechanical seal as per Manufacturer's Standard                                                        |         |
| 31                                          | Type of bearings for pump                                                                                                                                                                                                                                                                                                                     | To be mentioned by Bidder                                                                             |         |
| 32                                          | Bearings lubrication                                                                                                                                                                                                                                                                                                                          | To be mentioned by Bidder                                                                             |         |
| 33                                          | Coupling used between Pump and Motor                                                                                                                                                                                                                                                                                                          | As per Cl. No. 5.3.0 of Doc. No. PY-AS-4-M096-8371-01                                                 |         |
| 34                                          | Relief Valve                                                                                                                                                                                                                                                                                                                                  | 1 No. for Each Valve                                                                                  |         |
| <b>PERFORMANCE TEST STANDARD FOR PUMPS</b>  |                                                                                                                                                                                                                                                                                                                                               |                                                                                                       |         |
| 34                                          | Performance test standard                                                                                                                                                                                                                                                                                                                     | To be mentioned by Bidder                                                                             |         |
| 35                                          | Maximum Allowed Working Pressure (MAWP) in Kg/cm <sup>2</sup> g                                                                                                                                                                                                                                                                               |                                                                                                       |         |
| 36                                          | Hydraulic test pressure of casing Kg/cm <sup>2</sup> (g)                                                                                                                                                                                                                                                                                      | Hydraulic test pressure of casing shall be 1.5 times the MAWP. Test duration shall be minimum 30 min. |         |
| 37                                          | Noise level for Pump                                                                                                                                                                                                                                                                                                                          | To be mentioned by Bidder                                                                             |         |
| 38                                          | Vibration for Pump                                                                                                                                                                                                                                                                                                                            | To be mentioned by Bidder                                                                             |         |
| 39                                          | Pump Instruments                                                                                                                                                                                                                                                                                                                              | As per Manufacturer recommendation                                                                    |         |

**CUSTOMER: BHEL BHOPAL**  
**PROJECT: 4.5MLD STP PROJECT, BHEL-BHOPAL**

| Sl.no.               | Description                                                                                                                                                                                                  | BHEL Requirement                                                                                                                                                                    | DETAILS |
|----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|
| <b>MOTOR DETAILS</b> |                                                                                                                                                                                                              |                                                                                                                                                                                     |         |
| 61                   | Drive                                                                                                                                                                                                        | Motor                                                                                                                                                                               |         |
| 62                   | BKW at the rated point                                                                                                                                                                                       |                                                                                                                                                                                     |         |
| 63                   | BKW at end of curve                                                                                                                                                                                          |                                                                                                                                                                                     |         |
| 64                   | Selected drive rating in kW:<br>Motor Drive Rating (At 50 Deg.C ambient)<br>shall at least 25% above rated point or<br>maximum demand of the pump in the entire<br>operating range of the pump, whichever is | Bidder to mention motor kW rating for the motor duly<br>taking care of the requirements.                                                                                            |         |
| 65                   | Design Standard of Motor                                                                                                                                                                                     | IS 325/IEC60034                                                                                                                                                                     |         |
| 66                   | Energy Efficient Class                                                                                                                                                                                       | IE3 as per IS 12615                                                                                                                                                                 |         |
| 67                   | Manufacturer                                                                                                                                                                                                 | As per Approved Sub Vendor List                                                                                                                                                     |         |
| 68                   | Ambient Temperature                                                                                                                                                                                          | 50 Deg C<br>All motors shall be designed to operate in humid<br>atmosphere with a maximum ambient temperature of 50<br>Deg C.                                                       |         |
| 69                   | Area classification for motor/Canopy                                                                                                                                                                         | Safe Area/Canopy to be provided.                                                                                                                                                    |         |
| 70                   | Rated Voltage & Frequency                                                                                                                                                                                    | 415 V & 50 Hz                                                                                                                                                                       |         |
| 71                   | Permissible variations in<br>Voltage/Frequency/Combined                                                                                                                                                      | (+/-)/10%/(+/-)/5%/(+/-)/10%                                                                                                                                                        |         |
| 72                   | No of poles / synchronous speed                                                                                                                                                                              | Based on Pump Speed                                                                                                                                                                 |         |
| 73                   | Method of Starting                                                                                                                                                                                           | Motor shall be capable of starting with DOL                                                                                                                                         |         |
| 74                   | Method of cooling                                                                                                                                                                                            | To be Confirmed by Bidder                                                                                                                                                           |         |
| 75                   | Class of Insulation & Temp. rise                                                                                                                                                                             | Class F with Temperature rise ltd. to class B                                                                                                                                       |         |
| 76                   | Degree of protection/Canopy to be provided                                                                                                                                                                   | IP 55                                                                                                                                                                               |         |
| 77                   | TB Short time-Current & Short time-Time                                                                                                                                                                      | 40 kA , 0.25 Sec                                                                                                                                                                    |         |
| 78                   | Cable, Cable glands & Lugs                                                                                                                                                                                   | Cable details shall be furnished during DDE.<br>Accordingly suitable double compression Nickel plated<br>brass cable glands and Tinned copper lugs to be<br>provided by the bidder. |         |
| 79                   | No. of Starts                                                                                                                                                                                                | Motors shall be capable of three equally spread starts<br>per hour under normal condition or two starts in quick<br>succession from cold                                            |         |
| 80                   | Bearing RTDs, Winding RTDs & TGS                                                                                                                                                                             | As per Manufacturer Recommendation                                                                                                                                                  |         |

|                      |                                                                                   |                                                   |                                             |    |
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| ESP-001-2A<br>Rev.00 |  | <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b> | Std. / Doc. Number                          |    |
|                      |                                                                                   |                                                   | Annexure-3 to Doc. No. PY-AS-4-M096-8371-01 |    |
|                      |                                                                                   |                                                   | Rev. No.                                    | 00 |
|                      |                                                                                   |                                                   |                                             |    |

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|                                                   |                      |                     |                      |               |
|---------------------------------------------------|----------------------|---------------------|----------------------|---------------|
| <b>Revisions:</b><br>Refer to record of revisions | <b>Prepared by :</b> | <b>Checked by :</b> | <b>Approved by :</b> | <b>Date :</b> |
|                                                   | Rajeev Jain          | GIRISH              | Siva Prasad Babu     | 27.06.17      |

|                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                       |             |      |                 |             |
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|                                                                                                                                                                                   | <p align="center"><b>BHARAT HEAVY ELECTRICALS LIMITED</b><br/> <b>R.C.PURAM, HYDERABAD-502032</b></p>                                                                                                                                                                                                                                 |             |      |                 |             |
| <p align="center"><b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b></p>                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                       |             |      |                 |             |
| <p><b>PRICE FORMAT (R00) FOR SCREW SLUDGE LIFTING PUMP ASSEMBLY WITH ELECTRIC MOTOR DRIVE</b><br/> <b>FOR CUSTOMER : BHEL-BHOPAL</b><br/> <b>PROJECT : PROJECT 4.5 MLD STP,BHEL-BHOPAL</b></p>                                                                     |                                                                                                                                                                                                                                                                                                                                       |             |      |                 |             |
| SL NO                                                                                                                                                                                                                                                              | ITEM DESCRIPTION                                                                                                                                                                                                                                                                                                                      | QTY         | UNIT | UNIT RATE (RS.) | TOTAL (RS.) |
| <p><b>Bidder's Name : &lt;Bidder to indicate&gt;</b><br/> <b>Bidder's Offer No. &amp; Dt. : &lt;Bidder to indicate&gt;</b><br/> <b>Bidder's Ref No. &amp; Dt. :&lt;Bidder to indicate&gt;</b><br/> <b>BHEL Enq. No. &amp; date :&lt;Bidder to indicate&gt;</b></p> |                                                                                                                                                                                                                                                                                                                                       |             |      |                 |             |
| 1                                                                                                                                                                                                                                                                  | <b>MAIN OFFER</b>                                                                                                                                                                                                                                                                                                                     |             |      |                 |             |
| A                                                                                                                                                                                                                                                                  | <b>Screw Sludge Lifting Pumps(Positive Displacement Screw Type) with Drive Assembly:[8 m3/hr,10 mwc]</b>                                                                                                                                                                                                                              |             |      |                 |             |
| A.1.                                                                                                                                                                                                                                                               | <b>MATERIAL SUPPLY-Screw Sludge Lifting Pumps(Positive Displacement Screw Type) with Drive Assembly</b>                                                                                                                                                                                                                               |             |      |                 |             |
|                                                                                                                                                                                                                                                                    | Screw Sludge Lifting Pumps(Positive Displacement Screw Type) [8 m3/hr,10 mwc] with Drive Assembly (weather proof) with required accessories as per Manufacturer standard duly taking care of requirments mentioned in specification                                                                                                   | 2           | Set  |                 |             |
| A.2                                                                                                                                                                                                                                                                | <b>Commissioning spares</b>                                                                                                                                                                                                                                                                                                           |             |      |                 |             |
|                                                                                                                                                                                                                                                                    | One set of commissioning spares per pump shall be quoted as per manufacturer's recommendation.<br>(Ref. Note-12)                                                                                                                                                                                                                      | 2           | Set  |                 |             |
| A.3                                                                                                                                                                                                                                                                | <b>Special Tools &amp; tackles</b>                                                                                                                                                                                                                                                                                                    |             |      |                 |             |
|                                                                                                                                                                                                                                                                    | One set of Tools and tackles shall be quoted as per manufacturer's recommendation.                                                                                                                                                                                                                                                    | 1           | Set  |                 |             |
| A.4                                                                                                                                                                                                                                                                | <b>Supervision charges for erection &amp; commissioning at site</b>                                                                                                                                                                                                                                                                   |             |      |                 |             |
| a                                                                                                                                                                                                                                                                  | Travel expenses from vendor works to site and back per visit /person                                                                                                                                                                                                                                                                  |             |      |                 |             |
| b                                                                                                                                                                                                                                                                  | Per day charges per person for supervision of erection & commissioning at site including boarding, lodging, lcoal transportation etc., except for travel expenses as above.                                                                                                                                                           |             |      |                 |             |
| 2                                                                                                                                                                                                                                                                  | <b>Optional Items</b>                                                                                                                                                                                                                                                                                                                 |             |      |                 |             |
| A                                                                                                                                                                                                                                                                  | <b>2 Years Recommended Spares</b>                                                                                                                                                                                                                                                                                                     |             |      |                 |             |
|                                                                                                                                                                                                                                                                    | Recommended spares list for two years normal operation along with unit price breakup for Pump, Drive & other accessories[For Each Variety of pump seperate list to be provided]..<br><b>(List with price break up to be enclosed)</b><br>(1 set stands for quantity required for the replacement of one pump, drive (or) accessories) | As per List | Set  |                 |             |
| TOTAL                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                       |             |      |                 |             |
| Notes:                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                       |             |      |                 |             |
| 1) Bidder to quote strictly as per BHEL's NIT requirements.                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                       |             |      |                 |             |



|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                       |     |      |                 |             |
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|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | <p align="center"><b>BHARAT HEAVY ELECTRICALS LIMITED</b><br/> <b>R.C.PURAM, HYDERABAD-502032</b></p> |     |      |                 |             |
| <p align="center"><b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |     |      |                 |             |
| <p><b>PRICE FORMAT (R00) FOR SCREW SLUDGE LIFTING PUMP ASSEMBLY WITH ELECTRIC MOTOR DRIVE</b><br/> <b>FOR CUSTOMER : BHEL-BHOPAL</b><br/> <b>PROJECT : PROJECT 4.5 MLD STP,BHEL-BHOPAL</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                       |     |      |                 |             |
| SL NO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ITEM DESCRIPTION                                                                                      | QTY | UNIT | UNIT RATE (RS.) | TOTAL (RS.) |
| <p><b>Bidder's Name : &lt;Bidder to indicate&gt;</b><br/> <b>Bidder's Offer No. &amp; Dt. : &lt;Bidder to indicate&gt;</b><br/> <b>Bidder's Ref No. &amp; Dt. :&lt;Bidder to indicate&gt;</b><br/> <b>BHEL Enq. No. &amp; date :&lt;Bidder to indicate&gt;</b></p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                       |     |      |                 |             |
| <p>2) Bidder to note that this is a LUMP SUM Turn-Key Order. However<br/> (a) Changes to the tender specification during execution of the project for successful operation of the system need to be carried out by bidder and commercial implications if any will be settled suitably.<br/> (b) Unit rates quoted by bidder shall be applicable for any changes in BOQ during detailed engineering stage.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                       |     |      |                 |             |
| <p>3)Main offer consists of those items which will be part of main order after successful bidder is identified. Optional Items consists of those items which need to be quoted by bidder but may or may not be ordered by BHEL. Bidders are instructed to provide the pricing details listed under Main offer and Optional items as per the prescribed format.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                       |     |      |                 |             |
| <p>4) Prices quoted by bidders for items under main offer : Sl. No. I [A ] will be considered for evaluation of lowest bidder.</p> <p>For Supervision of E&amp;C, total no of 2 Man days to be covered in 1 Visit have been considered. However, either or both of the number of man days or no of visits may change on either side based on the actual site requirement.However, BHEL reserves the right</p> <p>(a) To include any of the optional items in scope of supply (as per customer contract requirements) and accordingly consider the same in evaluation. Any such scope increase and change in evalution will be intimated to vendor during technical evaluation(before price bid opening).</p> <p>(b) To place PO for any of the Optional items with in the contract period.</p> <p>Hence bidders need to mandatorily quote reasonable prices for all optional items considering such requirement and keep the validity of the prices till the end of contract period.</p> |                                                                                                       |     |      |                 |             |
| <p>5.a) For all items including Optional items, prices to be furnished in this prescribed price bid format only for each individual item. No combined prices, common prices or any other format will be accepted and such bids may be liable for rejection.<br/> 5.b) Bidder must not change the indicated item description, quantity &amp; units in the price bid format. Bidder should only fill the unit rates &amp; total price.<br/> 5.c) Bidder to quote for all the items as per price bid format. Incomplete/partial offer may be liable for rejection.</p>                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                       |     |      |                 |             |
| <p>6) Bidder to quote the base rates only. All other commercial charges for packing, freight, transportation, insurance, taxes &amp; duties etc., shall be indicated separately.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                       |     |      |                 |             |
| <p>7 a.) Commissioning spares are those spares which are required at the time of commissioning and shall be recommended(as per bidders experience) and quoted by bidder. However commissioning spares indicated in the price bid format shall be quoted as minimum.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |     |      |                 |             |
| <p><del>8)With respect to Mandatory Spares;</del><br/> A) <del>If any of above items indicated by the specified name are not applicable, bidder to offer alternative item serving the same function as per equipment's design and indicate below the item being replaced.</del><br/> B) <del>If bidder is not able to meet the above note, then bidder may mention "Not Applicable". However, if found applicable during detailed engg. stage or alternative item as per equipment design can serve the same function, bidder to supply the specified quantity with out any delivery and commercial implications to BHEL.</del></p>                                                                                                                                                                                                                                                                                                                                                      |                                                                                                       |     |      |                 |             |
| <p>9) Reference document: PY51222 R17 , BHEL Doc. No. PY-AS-4-M096-8371-01Rev. 00 &amp; annexures.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                       |     |      |                 |             |

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|                                                                                                                                                                                                                                                                                                                         | <p align="center"><b>BHARAT HEAVY ELECTRICALS LIMITED</b><br/> <b>R.C.PURAM, HYDERABAD-502032</b></p> |     |      |                       |                |
| <p align="center"><b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b></p>                                                                                                                                                                                                                                                                                                                                  |                                                                                                       |     |      |                       |                |
| <p><b>PRICE FORMAT (R00) FOR SCREW SLUDGE LIFTING PUMP ASSEMBLY WITH ELECTRIC MOTOR DRIVE</b><br/> <b>FOR CUSTOMER : BHEL-BHOPAL</b><br/> <b>PROJECT : PROJECT 4.5 MLD STP,BHEL-BHOPAL</b></p>                                                                                                                                                                                                           |                                                                                                       |     |      |                       |                |
| SL NO                                                                                                                                                                                                                                                                                                                                                                                                    | ITEM DESCRIPTION                                                                                      | QTY | UNIT | UNIT<br>RATE<br>(RS.) | TOTAL<br>(RS.) |
| <p><b>Bidder's Name : &lt;Bidder to indicate&gt;</b><br/> <b>Bidder's Offer No. &amp; Dt. : &lt;Bidder to indicate&gt;</b><br/> <b>Bidder's Ref No. &amp; Dt. :&lt;Bidder to indicate&gt;</b><br/> <b>BHEL Enq. No. &amp; date :&lt;Bidder to indicate&gt;</b></p>                                                                                                                                       |                                                                                                       |     |      |                       |                |
| <p>10) Unpriced price bid format indicating as quoted against each applicable item shall be submitted duly signed &amp; stamped along with technical offer by bidder as a token of concurrence that prices are submitted in this format only. The offer shall be liable for rejection in case if un-priced price bid format is not submitted or any modification is carried out in price bid format.</p> |                                                                                                       |     |      |                       |                |
| <p>11) <b>In case the systems are being supplied from outside India</b>, reputed Third Party Inspection like Llyods or equivalent has to be considered and the charges should be included in the Main offer. For those bidders who are supplying from India, such third party inspection charges need not be considered and same will be arranged by BHEL/BHEL nominated inspection agency.</p>          |                                                                                                       |     |      |                       |                |
| <p>12) Any commissioning spare consumed over and above the recommended commisioning spares, during commissioning shall be supplied free of cost by the equipment vendor.</p>                                                                                                                                                                                                                             |                                                                                                       |     |      |                       |                |

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|----------------------|-----------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------|----|
| ESP-001-2A<br>Rev.00 |  | <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b> | Std. / Doc. Number                          |    |
|                      |                                                                                   |                                                   | Annexure-4 to Doc. No. PY-AS-4-M096-8371-01 |    |
|                      |                                                                                   |                                                   | Rev. No.                                    | 00 |
|                      |                                                                                   |                                                   |                                             |    |

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|                                                                                                                                                                                                                                                |                                                       |  |  |  |

|                                                   |                      |                     |                      |               |
|---------------------------------------------------|----------------------|---------------------|----------------------|---------------|
| <b>Revisions:</b><br>Refer to record of revisions | <b>Prepared by :</b> | <b>Checked by :</b> | <b>Approved by :</b> | <b>Date :</b> |
|                                                   | Rajeev Jain          | GIRISH              | Siva Prasad Babu     | 27.06.17      |

## **ANNEXURE-4**

### **CHECKLIST FOR OFFER FOR SCREW SLUDGE LIFTING PUMP WITH DRIVE ASSEMBLY**

| <b>Description</b>                                                                                                                                                                                                                      | <b>Enclosed (Yes/No)</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|
| Bidder to confirm to the scope of supply as per BHEL specs Doc. No. PY-AS-4-M096-8371-01.                                                                                                                                               |                          |
| Bidder to furnish duly filled Pump-Motor datasheet as per Annexure-2. <b><u>Datasheets in other formats are strictly not accepted. Bidder to furnish filled in the Datasheets as per BHEL tender enquiry only.</u></b>                  |                          |
| Bidder to ensure that progressive cavity pump is quoted inline with Cl. No. 5.0.0 of BHEL Spec (Doc. No. PY-AS-4-M096-8371-01)                                                                                                          |                          |
| Bidder to confirm that all the Suitable reducers/expanders & counter flanges along with gaskets & stud nuts at all the terminal point, shall be in their scope inline with P&ID (Annexure-1 of Doc. No. PY-AS-4-M096-8371-01).          |                          |
| Bidder to confirm that the Motor Efficiency class considered is IE3 as per IS 12615 as mentioned in Cl. No. 5.2.0 of Doc. No. PY-AS-4-M096-8371-01.                                                                                     |                          |
| s Bidder to furnish a list of commissioning spares (Refer Cl. No. 5.11 of Doc. No PY-AS-4-M096-8371-01).                                                                                                                                |                          |
| Bidder to furnish a list of special tools & tackles (Refer Cl. No. 5.13 of Doc. No. PY-AS-4-M096-8371-01).                                                                                                                              |                          |
| Bidder's confirmation required for furnishing a list of 2 year recommended spares in their offer separately with optional price.                                                                                                        |                          |
| Bidder to furnish reference list for the offered pump in line with Cl. No. 7.0.0 of Doc. No. PY-AS-4-M096-8371-01.                                                                                                                      |                          |
| Bidder to furnish the filled in unpriced price bid format along with their offer as per Annexure-3 of Doc. No. PY-AS-4-M096-8371-01.                                                                                                    |                          |
| Bidder to quote individual price for each item mentioned in the seal priced bid as per price bid format (Annexure-03 of BHEL specs Doc. No. of Doc. No. PY-AS-4-M096-8371-01). Bidder to confirm the same.                              |                          |
| Deviations to the BHEL tender specifications shall be clearly bought by bidder in a separate deviation list. Bidder to furnish deviation list, if any, as per Annexure-08 of BHEL specs Doc. No. of Doc. No. PY-AS-4-M096-8371-01       |                          |
| All important documents such as unpriced price bid, reference list, pump performance curve, Pump & drive assembly GA drawings, CS drawings must necessarily to be furnished by bidder along with their offer.                           |                          |
| Bidder to raise Pre bid queries, if any, must be raised as per Attached format (Annexure-07) before submission of technical and commercial bid. Any deviation/ queries raised during technical bid submission shall not be entertained. |                          |

SIGNATURE:  
NAME:  
DESIGNATION:  
COMPANY:  
DATE:

|                      |                                                                                   |                                                   |                                             |    |
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| ESP-001-2A<br>Rev.00 |  | <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b> | Std. / Doc. Number                          |    |
|                      |                                                                                   |                                                   | Annexure-5 to Doc. No. PY-AS-4-M096-8371-01 |    |
|                      |                                                                                   |                                                   | Rev. No.                                    | 00 |
|                      |                                                                                   |                                                   |                                             |    |

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|                                                                                                                                                                                                                                                |                                                        |  |  |  |

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|---------------------------------------------------|----------------------|---------------------|----------------------|---------------|
| <b>Revisions:</b><br>Refer to record of revisions | <b>Prepared by :</b> | <b>Checked by :</b> | <b>Approved by :</b> | <b>Date :</b> |
|                                                   | Rajeev Jain          | GIRISH              | Siva Prasad Babu     | 27.06.17      |

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| TD-201<br>Rev No. 00<br>Form No.                                                                                                                                                                                                    | <br>HYDERABAD                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>PRODUCT STANDARD</b><br>PROJECT ENGINEERING & SYSTEMS DIVISION<br>HYDERABAD | ANNEXURE    |
|                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                | Rev No. 00  |
|                                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                | Page 1 of 3 |
| <b>COPYRIGHT AND CONFIDENTIAL</b><br><br>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED,<br>It must not be used directly or indirectly in any way detrimental to the interest of the company. | <div>QAP GUIDELINES &amp; FORMAT</div> <div>( ANNEXURE)</div> <p>The QAP format and guidelines for filling up the format shall be used by vendor for preparation and submission of QAP after order placement.</p> <p><b>Note :</b></p> <ol style="list-style-type: none"><li>1. Typical /Indicative /Standard QAP(s) for equipment /package attached is reference document and to use by successful bidder in future for preparation and submission of QAP for BHEL /CUSTOMER approval.</li><li>2. No deviation to reference document is acceptable.</li></ol> |                                                                                |             |

|                                                                                                                                                                                                                                  |                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                       |
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| Form No.                                                                                                                                                                                                                         | <br>HYDERABAD | <b>PRODUCT STANDARD</b><br>PROJECT ENGINEERING & SYSTEMS DIVISION<br>HYDERABAD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ANNEXURE<br>Rev No. 00<br>Page 2 of 3 |
| <b>COPYRIGHT AND CONFIDENTIAL</b><br>The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .<br>It must not be used directly or indirectly in any way detrimental to the interest of the company. |                                                                                               | <p style="text-align: center;"><b><u>GUIDELINES TO VENDORS FOR<br/>PREPARATION OF QUALITY ASSURANCE PLAN</u></b></p> <ol style="list-style-type: none"> <li>1. QAP shall be made in landscape mode on A4 size paper as per the format enclosed.<br/>Font size shall be minimum 10.</li> <li>2. Each page of QAP shall contain the following information.           <ol style="list-style-type: none"> <li>a) Vendor's name &amp; address.</li> <li>b) Customer: BHEL, Hyderabad.</li> <li>c) Project.</li> <li>d) BHEL Product Standard Number/revision number as referred in P.O.</li> <li>e) BHEL Purchase Order Number &amp; Date.</li> <li>f) Product as per P.O. description.</li> <li>g) QAP Number (unique and shall not repeat)/revision number/date.</li> <li>h) Page number and number of pages</li> </ol> </li> <li>3. QAP shall contain four parts / stages as follows.           <ol style="list-style-type: none"> <li>a) Raw materials and bought out items.</li> <li>b) In process Control / Inspection.</li> <li>c) Final assembly, Inspection &amp; Testing.</li> <li>d) Painting, preservation &amp; packing.</li> </ol> </li> <li>4. Under 'Component', indicate name of the component (say casing, rotor, pressure gauge, etc).</li> <li>5. Under 'Characteristics', indicate appropriately (say chemical analysis, mechanical properties, NDT (UT,DP etc.), hydrostatic test, calibration check etc.)</li> <li>6. Under 'Class', indicate minor, major or critical depending on the importance of characteristic.</li> <li>7. Under 'Type of check', indicate appropriately (say chemical, mechanical, UT, DP etc.)</li> <li>8. Under 'Quantum of check', indicate appropriately (say 100%, 10%, sample, per melt, per heat, all pieces etc.)</li> <li>9. Under 'Reference document' and 'Acceptance norms', appropriate National &amp; International standards, BHEL standards, approved drawing references etc. should be indicated. It is not correct to mention as "Vendor's internal standards or Vendor's standard practice etc.". If vendors' internal standards are referred, same shall be in line with BHEL Spec. indicated in the P.O. These may require review &amp; approval by our Engineering dept.</li> <li>10. Under 'Format of record', indicate appropriately supplier's test certificate, calibration certificate, lab report, inspection report etc.</li> </ol> |                                       |
|                                                                                                                                                                                                                                  | Ref. Doc                                                                                      | 11. Please refer 'Agency' in QAP format.<br>Under P: Perform, W: Witness, V: Verify<br>Indicate against each characteristic 1: (BHEL CQS/Nominated inspection agency), OR<br>2: (Vendor / Sub vendor)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                       |

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| Form No.                                                                                                                                                                                                                                                                                                        | <br>HYDERABAD | <div style="text-align: center;"> <b>PRODUCT STANDARD</b><br/> PROJECT ENGINEERING &amp; SYSTEMS DIVISION<br/> HYDERABAD </div>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ANNEXURE |
|                                                                                                                                                                                                                                                                                                                 | Rev No. 00                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |
|                                                                                                                                                                                                                                                                                                                 | Page 3 of 3                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |
| <div style="writing-mode: vertical-rl; transform: rotate(180deg);"> <b>COPYRIGHT AND CONFIDENTIAL</b><br/> The information on this document is the property of BHARAT HEAVY ELECTRICALS LIMITED .<br/> It must not be used directly or indirectly in any way detrimental to the interest of the company. </div> |                                                                                               | <p>Note: Performing agency is normally vendor or his sub vendor (Legend 2). Where witness points are indicated in specification, P.O., Drawing etc., for such operations, Under Witness (W) column use 1. Under 'Verify' column, use code 1.</p> <p>12. Under 'D' please put ( <input type="checkbox"/> Tick) against each characteristic where vendor proposes to submit test certificate/report etc. OR as required as per BHEL Specification.</p> <p>13. Vendor's signature &amp; stamp should be available on each page of QAP.</p> <p>14. Vendor should read the BHEL Product Standard thoroughly and QAP should be made only inline and relevant to the Specification &amp; Approved Drawings.</p> <p>15. The following operations/characteristics/check points may be included (AS APPROPRIATE)</p> <ol style="list-style-type: none"> <li>a) Visual check</li> <li>b) Dimensional check</li> <li>c) Mechanical and Chemical properties.</li> <li>d) Surface preparation before painting (by chemical cleaning, sand blasting, shot blasting etc. as the case may be.)</li> <li>e) Painting check for shade, Dry Film Thickness (DFT), Adhesion/ peel off test etc.</li> <li>f) Check for correctness for all components mounted as per General arrangement Drawing, Bill Of Materials (BOM), etc. for range, rating, make, color, size, location as per GA, quantity, label description including tag nos., annunciator facia, loose components, accessories, spares etc.</li> <li>g) Verification of test certificate for protection class for the enclosures.</li> <li>h) Mechanical functioning of switches.</li> <li>i) Continuity of earthing and provision of earth points.</li> <li>j) Colour coding of wiring, size, tightness &amp; dressing of wiring.</li> <li>k) Review of test certificates of assembled items, raw materials, internal test reports etc.</li> <li>l) Witness of functional checks, which may include mechanical run &amp; electrical run, H.V.test, IR measurement, Electrical and Mechanical tests etc.</li> <li>m) PQR, WPS, Welder Qualification Record, welding records (fit up, DP) etc.</li> <li>n) Material identification ( for punch marks of serial numbers, Heat No, Melt No, Inspector's stamp etc.)</li> <li>o) Hydraulic Pressure Test, Pneumatic Pressure Test, Liquid Penetration Examination and other Non-Destructive Tests.</li> <li>p) Tests on Galvanised items (Visual, Hammer Test, Knife Test, Thickness, Pierce Test (Copper sulphate test), Hydrogen evaluation test, Stripping test (for Mass of Zinc coating)</li> <li>q) All tests as per BHEL Product Standard &amp; approved drawings including Type tests and Routine tests on individual items and on System as a whole.</li> <li>r) Packing and Preservation.</li> </ol> <p>16. <b>QAP Format enclosed.</b></p> <p>17. <b>Typical Manufacturing QAP(s) is /are attached.</b></p> |          |
|                                                                                                                                                                                                                                                                                                                 |                                                                                               | Ref. Doc                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |          |



| VENDOR'S NAME & ADDRESS: |                                             |                 | <b>MANUFACTURING QUALITY PLAN</b> |               |                  |                         |                  |                  | QP. NO.: |                 |             |  |         |
|--------------------------|---------------------------------------------|-----------------|-----------------------------------|---------------|------------------|-------------------------|------------------|------------------|----------|-----------------|-------------|--|---------|
|                          |                                             |                 | CUSTOMER: BHEL, HYDERABAD – 32.   |               |                  | BHEL P.O.NO.:           |                  |                  | REV NO:  |                 | DATE:       |  |         |
|                          |                                             |                 | PROJECT:<br>PRODUCT:              |               |                  | P.O.DATE:<br>BHEL SPEC: |                  |                  | REV:     |                 | PAGE 1 OF 1 |  |         |
| SL NO                    | COMPONENTS                                  | CHARACTERISTICS | CLASS                             | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT      | ACCEPTANCE NORMS | FORMAT OF RECORD | * D      | AGENCY<br>P W V |             |  | REMARKS |
| 1.0                      | <b>RAW MATERIALS &amp; BOUGHT OUT ITEMS</b> |                 |                                   |               |                  |                         |                  |                  |          |                 |             |  |         |
|                          |                                             |                 |                                   |               |                  |                         |                  |                  |          |                 |             |  |         |
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| 2.0                      | <b>INPROCESS INSPECTION</b>                 |                 |                                   |               |                  |                         |                  |                  |          |                 |             |  |         |
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| 3.0                      | <b>FINAL INSPECTION &amp; TESTING</b>       |                 |                                   |               |                  |                         |                  |                  |          |                 |             |  |         |
|                          |                                             |                 |                                   |               |                  |                         |                  |                  |          |                 |             |  |         |
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| 4.0                      | <b>PRESERVATION &amp; PACKING</b>           |                 |                                   |               |                  |                         |                  |                  |          |                 |             |  |         |
|                          |                                             |                 |                                   |               |                  |                         |                  |                  |          |                 |             |  |         |
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**VENDOR TO NOTE:** THIS FORMAT IS IN MICROSOFT WORD. HEADER & FOOTER SHALL BE AVAILABLE IN EACH PAGE OF QP. QP SHALL BE IN LANDSCAPE & A4 SIZE ONLY. FONT SIZE SHALL BE MIN 10. VENDOR SHALL SIGN & STAMP IN EACH PAGE OF QP. LOI REF. & DATE ARE NOT ACCEPTABLE. P.O.NO. & DATE SHALL BE INDICATED. QP NO. SHOULD BE UNIQUE AND SHALL NOT REPEAT. ALL THE TESTS / CHECKS INDICATED IN THE BHEL SPEC. SHALL BE INDICATED IN THE QP.

|                                                                                                                                                                                                                                                                                                                             |                            |                           |                              |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|---------------------------|------------------------------|
| LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS. | PREPARED BY                | APPROVED BY               | APPROVED BY                  |
|                                                                                                                                                                                                                                                                                                                             | VENDOR'S SIGNATURE & STAMP | BHEL QA SIGNATURE & STAMP | CUSTOMER'S SIGNATURE & STAMP |

|                                                 |                                                                               |                                                                                          |       |                                             |                                                     |                                                    |                  |                       |     |        |   |   |                                      |
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| <div><div>बी एच ई एल</div><div>BHEL</div></div> |                                                                               | TYPICAL MANUFACTURING QUALITY PLAN                                                       |       |                                             |                                                     |                                                    |                  | MQP. NO.:             |     |        |   |   |                                      |
|                                                 |                                                                               | PROJECT ENGINEERING & SYSTEMS<br>DIVISION BHEL,<br>RC PURAM, HYD-502032                  |       |                                             | PROJECT:<br>PACKAGE: SCREW PUMPS<br>BHEL TECH SPEC: |                                                    |                  | REV NO:               |     | DATE:  |   |   |                                      |
|                                                 |                                                                               |                                                                                          |       |                                             |                                                     |                                                    |                  | PAGE 1 OF 3           |     |        |   |   |                                      |
| SL NO                                           | COMPONENTS                                                                    | CHARACTERISTICS                                                                          | CLASS | TYPE OF CHECK                               | QUANTUM OF CHECK                                    | REFERENCE DOCUMENT                                 | ACCEPTANCE NORMS | FORMAT OF RECORD      | * D | AGENCY |   |   | REMARKS                              |
|                                                 |                                                                               |                                                                                          |       |                                             |                                                     |                                                    |                  |                       |     | P      | W | V |                                      |
| 1.0                                             | RAW MATERIALS & BOUGHT OUT ITEMS                                              |                                                                                          |       |                                             |                                                     |                                                    |                  |                       |     |        |   |   |                                      |
| 1.1                                             | Casing                                                                        | Chemical & Mech. Properties                                                              | Major | Chemical & Mech. analysis                   | 1 per heat/lot                                      | Tech Spec/ Approved Datasheet/<br>Approved Drawing |                  | MTC                   | √   | 2      | 2 | 1 |                                      |
| 1.2                                             | Screw shaft & Gears                                                           | Chemical & Mech. Properties                                                              | Major | Chemical & Mech. Analysis                   | 1 per heat/lot                                      |                                                    |                  | MTC                   | √   | 2      | 2 | 1 |                                      |
| 1.3                                             | Mechanical seal                                                               | Material and leakage check (Air test)                                                    | Major | OEM's certificate review                    | 100%                                                |                                                    |                  | MTC / COC             | √   | 2      | 2 | 1 |                                      |
| 1.4                                             | Bearing and bearing housing                                                   | Make and Model                                                                           | Major | Visual                                      | 100%                                                |                                                    |                  | MTC / COC             | √   | 2      | 2 | 1 |                                      |
| 1.5                                             | Accessories *                                                                 | Chemical & Mech. Properties                                                              | Major | Chemical & Mech. Analysis                   | 1 per heat/lot                                      |                                                    |                  | MTC                   | √   | 2      | 2 | 1 | * accessories as per scope of supply |
| 1.6                                             | (inter connecting piping, strainers, filters, Gear box, instruments, JB etc.) | MOC, hydro test reports, Calibration reports and Type test certificates for instruments. | Major | OEM's certificate review                    | 100%                                                |                                                    |                  | OEM test certificates | √   | 2      | 2 | 1 |                                      |
| 1.7                                             | Wear rings                                                                    | Chemical & Mech. Properties and hardness                                                 | Major | Chemical & Mech. Analysis and hardness test | 1 per heat/lot                                      |                                                    |                  | MTC                   | √   | 2      | 2 | 1 |                                      |

LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. \* FOR ITEMS MARKED ✓ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS.

|                                                                                                                              |                                            |                                                                         |          |                                                  |                                                     |                                                    |                  |                  |     |                     |   |    |          |
|------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------|-------------------------------------------------------------------------|----------|--------------------------------------------------|-----------------------------------------------------|----------------------------------------------------|------------------|------------------|-----|---------------------|---|----|----------|
| <div><div>बी एच ई एल</div><div></div></div> |                                            | TYPICAL MANUFACTURING QUALITY PLAN                                      |          |                                                  |                                                     |                                                    |                  | MQP. NO.:        |     |                     |   |    |          |
|                                                                                                                              |                                            | PROJECT ENGINEERING & SYSTEMS<br>DIVISION BHEL,<br>RC PURAM, HYD-502032 |          |                                                  | PROJECT:<br>PACKAGE: SCREW PUMPS<br>BHEL TECH SPEC: |                                                    |                  | REV NO:          |     | DATE:               |   |    |          |
|                                                                                                                              |                                            |                                                                         |          |                                                  |                                                     |                                                    |                  | PAGE 2 OF 3      |     |                     |   |    |          |
| SL NO                                                                                                                        | COMPONENTS                                 | CHARACTERISTICS                                                         | CLASS    | TYPE OF CHECK                                    | QUANTUM OF CHECK                                    | REFERENCE DOCUMENT                                 | ACCEPTANCE NORMS | FORMAT OF RECORD | * D | AGENCY<br>P   W   V |   |    | REMARKS  |
| 1.8                                                                                                                          | Gaskets, Flanges, and Fasteners            | Chemical & Mech. Properties                                             | Minor    | Chemical & Mech. Analysis                        | 1 per heat/lot                                      |                                                    |                  | MTC              | √   | 2                   | 2 | 1  |          |
| 2.0                                                                                                                          | INPROCESS INSPECTION                       |                                                                         |          |                                                  |                                                     |                                                    |                  |                  |     |                     |   |    |          |
| 2.1                                                                                                                          | Fabrication of casing and other components | WPS, PQR and WQR                                                        | Major    | Document verification                            | 100%                                                | Tech Spec/ Approved Datasheet/<br>Approved Drawing |                  | WPS, PQR and WQR | --  | 2                   | 2 | 1  |          |
| 2.2                                                                                                                          | Casing                                     | Surface finish & NDE                                                    | Major    | Visual and DPT/MPI                               | 100%                                                |                                                    |                  | NDE reports      | √   | 2                   | 2 | 1  |          |
| 2.3                                                                                                                          |                                            | Leakage                                                                 | Critical | Hydro test                                       | 100%                                                |                                                    |                  | Test reports     | √   | 2                   | 1 | -- |          |
| 2.4                                                                                                                          | Butt welds on pressure containing parts*   | NDE                                                                     | Major    | RT                                               | 100%                                                |                                                    |                  | IR               | √   | 2                   | 2 | 1  | * if any |
| 2.5                                                                                                                          | Screw shaft & Gears                        | NDE and hardness                                                        | Major    | DPT/MPI for all and UT (if shaft diameter> 50mm) | 100%                                                |                                                    |                  | NDE reports      | √   | 2                   | 2 | 1  |          |
| 2.6                                                                                                                          | Wear rings                                 | NDE                                                                     | Major    | DPT                                              | 100%                                                |                                                    |                  | DP reports       | √   | 2                   | 2 | 1  |          |

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|                                                                                                                                                                                                                                            |                                   | TYPICAL MANUFACTURING QUALITY PLAN           |          |                      |                  |                                                 |                  | MQP. NO.:        |     |             |    |    |                                                                                           |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|----------------------------------------------|----------|----------------------|------------------|-------------------------------------------------|------------------|------------------|-----|-------------|----|----|-------------------------------------------------------------------------------------------|
|                                                                                                                                                                                                                                                                                                                             |                                   | PROJECT ENGINEERING & SYSTEMS                |          | PROJECT:             |                  | REV NO:                                         |                  | DATE:            |     |             |    |    |                                                                                           |
|                                                                                                                                                                                                                                                                                                                             |                                   | DIVISION BHEL,                               |          | PACKAGE: SCREW PUMPS |                  |                                                 |                  |                  |     | PAGE 3 OF 3 |    |    |                                                                                           |
|                                                                                                                                                                                                                                                                                                                             |                                   | RC PURAM, HYD-502032                         |          | BHEL TECH SPEC:      |                  |                                                 |                  |                  |     |             |    |    |                                                                                           |
| SL NO                                                                                                                                                                                                                                                                                                                       | COMPONENTS                        | CHARACTERISTICS                              | CLASS    | TYPE OF CHECK        | QUANTUM OF CHECK | REFERENCE DOCUMENT                              | ACCEPTANCE NORMS | FORMAT OF RECORD | * D | AGENCY      |    |    | REMARKS                                                                                   |
|                                                                                                                                                                                                                                                                                                                             |                                   |                                              |          |                      |                  |                                                 |                  |                  |     | P           | W  | V  |                                                                                           |
| 2.7                                                                                                                                                                                                                                                                                                                         | Rotor assembly with coupling half | Dynamic balancing                            | Critical | Balancing            | 100%             |                                                 |                  | IR               | √   | 2           | 2  | 1  |                                                                                           |
| 3.0 FINAL INSPECTION & TESTING                                                                                                                                                                                                                                                                                              |                                   |                                              |          |                      |                  |                                                 |                  |                  |     |             |    |    |                                                                                           |
| 3.1                                                                                                                                                                                                                                                                                                                         | Pump assembly with job motor      | Performance test                             | Critical | Testing              | 100%             | Tech Spec/ Approved Datasheet/ Approved Drawing |                  | TC               | √   | 2           | 1  | -- | Only 10% witness by BHEL / BHEL's TPIA, subjective to minimum 1 pump of each size & type. |
| 3.2                                                                                                                                                                                                                                                                                                                         |                                   | NPSH (if applicable)                         | Critical | Testing              | 100%             |                                                 |                  | TC               | √   | 2           | 1  | -- |                                                                                           |
| 3.3                                                                                                                                                                                                                                                                                                                         |                                   | Mechanical run test                          | Critical | Testing              | 100%             |                                                 |                  | TC               | √   | 2           | 1  | -- |                                                                                           |
| 3.4                                                                                                                                                                                                                                                                                                                         |                                   | Strip Examination                            | Critical | Dismantling          | 100%             |                                                 |                  | TC               | √   | 2           | 1  | -- |                                                                                           |
| 3.5                                                                                                                                                                                                                                                                                                                         |                                   | Overall Dimensions                           | Major    | Measurement          | 100%             |                                                 |                  | IR               | √   | 2           | 1  | -- |                                                                                           |
| 3.6                                                                                                                                                                                                                                                                                                                         |                                   | Complete unit test                           | Major    | Testing              | 100%             |                                                 |                  | IR               | √   | 2           | 1  | -- |                                                                                           |
| 3.7                                                                                                                                                                                                                                                                                                                         |                                   | Spares (if any)                              | Major    | BOM check            | 100%             |                                                 | IR               | √                | 2   | 1           | -- |    |                                                                                           |
| 4.0 PRESERVATION & PACKING                                                                                                                                                                                                                                                                                                  |                                   |                                              |          |                      |                  |                                                 |                  |                  |     |             |    |    |                                                                                           |
| 4.1                                                                                                                                                                                                                                                                                                                         | Pump and its components           | Direction of rotation, Stamping and Painting | Major    | Visual, Shade & DFT  | Random           | Tech Spec/ Approved Datasheet/ Approved Drawing |                  | IR               | √   | 2           | 1  | -- |                                                                                           |
| 4.2                                                                                                                                                                                                                                                                                                                         |                                   | Packing #                                    | Major    | Visual               | 100%             |                                                 |                  | Packing List     | √   | 2           | 2  | 1  | # Seaworthy packing for export orders                                                     |
| LEGEND: P: PERFORM, W: WITNESS, V: VERIFICATION. INDICATE 1 FOR BHEL CQS (OR BHEL NOMINATED INSPECTION AGENCY) & 2 FOR VENDOR/SUB VENDOR AS APPROPRIATE AGAINST EACH COMPONENT /CHARACTERISTIC UNDER P, W & V COLUMNS. * FOR ITEMS MARKED √ (TICK) IN COLUMN 'D', TEST CERTIFICATES SHALL BE SUBMITTED TO BHEL FOR RECORDS. |                                   |                                              |          |                      |                  |                                                 |                  |                  |     |             |    |    |                                                                                           |

|                                                                                   |            |                                                                         |       |               |                                                     |                    |                  |                  |   |       |                     |  |  |         |
|-----------------------------------------------------------------------------------|------------|-------------------------------------------------------------------------|-------|---------------|-----------------------------------------------------|--------------------|------------------|------------------|---|-------|---------------------|--|--|---------|
|  |            | <b>TYPICAL MANUFACTURING QUALITY PLAN</b>                               |       |               |                                                     |                    |                  | MQP. NO.:        |   |       |                     |  |  |         |
|                                                                                   |            |                                                                         |       |               |                                                     |                    |                  | REV NO:          |   | DATE: |                     |  |  |         |
|                                                                                   |            | PROJECT ENGINEERING & SYSTEMS<br>DIVISION BHEL,<br>RC PURAM, HYD-502032 |       |               | PROJECT:<br>PACKAGE: SCREW PUMPS<br>BHEL TECH SPEC: |                    |                  | PAGE 4 OF 3      |   |       |                     |  |  |         |
| SL NO                                                                             | COMPONENTS | CHARACTERISTICS                                                         | CLASS | TYPE OF CHECK | QUANTUM OF CHECK                                    | REFERENCE DOCUMENT | ACCEPTANCE NORMS | FORMAT OF RECORD | * | D     | AGENCY<br>P   W   V |  |  | REMARKS |

**Notes:-**

1. This MQP should be read along with specification ((Latest revisions to be considered as per PO), approved drawings & approved datasheet.
2. Specification/drawing/datasheet shall prevail over quality plan for contradiction if any.
3. Any project/customer specific requirements which shall be notified have to be fulfilled by the vendor at the time of execution of order.

**Abbreviations:-**

|     |   |                           |     |   |                             |     |   |                    |
|-----|---|---------------------------|-----|---|-----------------------------|-----|---|--------------------|
| MTC | – | Material Test certificate | COC | – | Certificate of Compliance   | DFT | – | Dry Film Thickness |
| TC  | – | Test Certificate          | NDE | – | Non Destructive Examination | IR  | – | Inspection Report  |
| DFT | – | Dry Film Thickness        | IBR | – | Indian Boiler Regulations   | IS  | – | Indian Standards   |

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|  |                                                              | <b>TYPICAL MANUFACTURING QUALITY PLAN</b>                                                                                                     |       |                                                 |                                                      |                                                                                                       |                  | MQP. NO.:                      |     |        |   |   |         |
|-----------------------------------------------------------------------------------|--------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------------------------------------|------------------------------------------------------|-------------------------------------------------------------------------------------------------------|------------------|--------------------------------|-----|--------|---|---|---------|
|                                                                                   |                                                              |                                                                                                                                               |       |                                                 |                                                      |                                                                                                       |                  | REV NO:                        |     | DATE:  |   |   |         |
|                                                                                   |                                                              | PROJECT ENGINEERING & SYSTEMS<br>DIVISION BHEL,<br>RC PURAM, HYD-502032                                                                       |       |                                                 | PROJECT:<br>PACKAGE: <b>MOTOR</b><br>BHEL TECH SPEC: |                                                                                                       |                  | PAGE 1 OF 4                    |     |        |   |   |         |
| SL NO                                                                             | COMPONENTS                                                   | CHARACTERISTICS                                                                                                                               | CLASS | TYPE OF CHECK                                   | QUANTUM OF CHECK                                     | REFERENCE DOCUMENT                                                                                    | ACCEPTANCE NORMS | FORMAT OF RECORD               | * D | AGENCY |   |   | REMARKS |
|                                                                                   |                                                              |                                                                                                                                               |       |                                                 |                                                      |                                                                                                       |                  |                                |     | P      | W | V |         |
| <b>1.0 RAW MATERIALS &amp; BOUGHT OUT ITEMS</b>                                   |                                                              |                                                                                                                                               |       |                                                 |                                                      |                                                                                                       |                  |                                |     |        |   |   |         |
| 1.1                                                                               | <u>COPPER WIRE</u><br>Enameled Copper Wire                   | Overall diameter, elongation, Mandrel winding test, Peel test, springiness, Abrasion test, Cut through test, Heat shock test, Continuity test | Major | Measurement and mechanical & electrical testing | One sample per heat/lot                              | National & international standard ( IS or IEC) / technical specification/ approved drawing/ datasheet |                  | IR / supplier test certificate | √   | 2      | 2 | 1 |         |
| 1.2                                                                               | <u>STEEL SHAFT</u><br>Straightened Steel bar in black Finish | Dimensions, surface finish, chemical composition                                                                                              | Major | Visual, measurement and chemical testing        | One sample per heat/lot                              |                                                                                                       |                  | supplier test certificate      | √   | 2      | 2 | 1 |         |
| 1.3                                                                               |                                                              | NDT                                                                                                                                           | Major | UT                                              | 100%                                                 |                                                                                                       |                  | supplier test certificate      | √   | 2      | 2 | 1 |         |
| 1.4                                                                               | <u>ALUMINIUM INGOTS</u>                                      | Chemical properties                                                                                                                           | Major | Chemical testing                                | One sample per heat/lot                              |                                                                                                       |                  | supplier test certificate      | √   | 2      | 2 | 1 |         |
| <b>2.0 INPROCESS INSPECTION</b>                                                   |                                                              |                                                                                                                                               |       |                                                 |                                                      |                                                                                                       |                  |                                |     |        |   |   |         |
| 2.1                                                                               | ASSEMBLY                                                     | Completeness and correctness of assembly                                                                                                      | Major | Visual verification                             | 100%                                                 | MO and manufacturer's internal processes                                                              |                  | Log book                       | --  | 2      | 2 | 2 |         |

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|                                                 |                            |                                                                         |       |               |                                                      |                                                                           |                  |                  |     |        |   |    |         |
|-------------------------------------------------|----------------------------|-------------------------------------------------------------------------|-------|---------------|------------------------------------------------------|---------------------------------------------------------------------------|------------------|------------------|-----|--------|---|----|---------|
| <div><div>बी एच ई एल</div><div>BHEL</div></div> |                            | TYPICAL MANUFACTURING QUALITY PLAN                                      |       |               |                                                      |                                                                           |                  | MQP. NO.:        |     |        |   |    |         |
|                                                 |                            | PROJECT ENGINEERING & SYSTEMS<br>DIVISION BHEL,<br>RC PURAM, HYD-502032 |       |               | PROJECT:<br>PACKAGE: <b>MOTOR</b><br>BHEL TECH SPEC: |                                                                           |                  | REV NO:          |     | DATE:  |   |    |         |
|                                                 |                            |                                                                         |       |               |                                                      |                                                                           |                  | PAGE 2 OF 4      |     |        |   |    |         |
| SL NO                                           | COMPONENTS                 | CHARACTERISTICS                                                         | CLASS | TYPE OF CHECK | QUANTUM OF CHECK                                     | REFERENCE DOCUMENT                                                        | ACCEPTANCE NORMS | FORMAT OF RECORD | * D | AGENCY |   |    | REMARKS |
|                                                 |                            |                                                                         |       |               |                                                      |                                                                           |                  |                  |     | P      | W | V  |         |
| 3.0                                             | FINAL INSPECTION & TESTING |                                                                         |       |               |                                                      |                                                                           |                  |                  |     |        |   |    |         |
| 3.1                                             | ROUTINE TESTING            | Measurement of winding resistance in cold condition                     | Major | Testing       | 100%                                                 | National & international standard ( IS or IEC ) / technical specification |                  | TC               | √   | 2      | 1 | -- |         |
| 3.2                                             |                            | SH heater resistance (if applicable)                                    | Major | Testing       | 100%                                                 |                                                                           |                  | TC               | √   | 2      | 1 | -- |         |
| 3.3                                             |                            | Insulation resistance (before and after HV test)                        | Major | Testing       | 100%                                                 |                                                                           |                  | TC               | √   | 2      | 1 | -- |         |
| 3.4                                             |                            | High voltage test at 1.8 KV for 1 minute and space heater HV test       | Major | Testing       | 100%                                                 |                                                                           |                  | TC               | √   | 2      | 1 | -- |         |
| 3.5                                             |                            | Direction of rotation                                                   | Major | Testing       | 100%                                                 |                                                                           |                  | TC               | √   | 2      | 1 | -- |         |
| 3.6                                             |                            | No load test (measurement of NL A, voltage, NL power and NL RPM)        | Major | Testing       | 100%                                                 |                                                                           |                  | TC               | √   | 2      | 1 | -- |         |
| 3.7                                             |                            | Reduced run up voltage test at ( rated volt√3)                          | Major | Testing       | 100%100%                                             |                                                                           |                  | TC               | √   | 2      | 1 | -- |         |
| 3.8                                             |                            | Locked rotor test at full load current                                  | Major | Testing       | 100%                                                 |                                                                           |                  | TC               | √   | 2      | 1 | -- |         |
| 3.9                                             |                            | Vibration measurement                                                   | Major | Testing       | 100%                                                 |                                                                           |                  | TC               | √   | 2      | 1 | -- |         |
| 3.10                                            |                            | Measurement of noise level                                              | Major | Testing       | 100%                                                 |                                                                           |                  | TC               | √   | 2      | 1 | -- |         |
| 3.11                                            |                            | 120% over speed test                                                    | Major | Testing       | 100%                                                 |                                                                           |                  | TC               | √   | 2      | 1 | -- |         |

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|                                                                                   |            |                                                                                               |       |               |                                                      |                                                                           |                  |                  |     |                 |    |   |                                                                                             |
|-----------------------------------------------------------------------------------|------------|-----------------------------------------------------------------------------------------------|-------|---------------|------------------------------------------------------|---------------------------------------------------------------------------|------------------|------------------|-----|-----------------|----|---|---------------------------------------------------------------------------------------------|
|  |            | TYPICAL MANUFACTURING QUALITY PLAN                                                            |       |               |                                                      |                                                                           |                  | MQP. NO.:        |     |                 |    |   |                                                                                             |
|                                                                                   |            | PROJECT ENGINEERING & SYSTEMS<br>DIVISION BHEL,<br>RC PURAM, HYD-502032                       |       |               | PROJECT:<br>PACKAGE: <b>MOTOR</b><br>BHEL TECH SPEC: |                                                                           |                  | REV NO:          |     | DATE:           |    |   |                                                                                             |
|                                                                                   |            |                                                                                               |       |               |                                                      |                                                                           |                  | PAGE 3 OF 4      |     |                 |    |   |                                                                                             |
| SL NO                                                                             | COMPONENTS | CHARACTERISTICS                                                                               | CLASS | TYPE OF CHECK | QUANTUM OF CHECK                                     | REFERENCE DOCUMENT                                                        | ACCEPTANCE NORMS | FORMAT OF RECORD | * D | AGENCY<br>P W V |    |   | REMARKS                                                                                     |
| 3.12                                                                              | TYPE TESTS | Measurement of winding resistance in cold condition                                           | Major | Testing       | One /rating                                          | National & international standard ( IS or IEC ) / technical specification |                  | TC               | √   | 2               | -- | 1 | Verification of Identical Type test Report of same Rating                                   |
| 3.13                                                                              |            | Temp. rise test at full load ( load point for 100%, 75% & 50% load ( full load, ¾ and ½ load) | Major | Testing       | One /rating                                          |                                                                           |                  | TC               | √   | 2               | -- | 1 |                                                                                             |
| 3.14                                                                              |            | 160% momentary overload test                                                                  | Major | Testing       | One /rating                                          |                                                                           |                  | TC               | √   | 2               | -- | 1 |                                                                                             |
| 3.15                                                                              |            | Locked rotor amp and torque test                                                              | Major | Testing       | One /rating                                          |                                                                           |                  | TC               | √   | 2               | -- | 1 |                                                                                             |
| 3.16                                                                              |            | No load test                                                                                  | Major | Testing       | One /rating                                          |                                                                           |                  | TC               | √   | 2               | -- | 1 | Identical type test reports for motor ratings (not more than 5 years old) will be provided. |
| 3.17                                                                              |            | Reduced voltage running up test                                                               | Major | Testing       | One /rating                                          |                                                                           |                  | TC               | √   | 2               | -- | 1 |                                                                                             |
| 3.18                                                                              |            | Insulation resistance test ( before and after HV test)                                        | Major | Testing       | One /rating                                          |                                                                           |                  | TC               | √   | 2               | -- | 1 |                                                                                             |
| 3.19                                                                              |            | HV test – 1.8 KV for winding and 1.5 KV for space heater                                      | Major | Testing       | One /rating                                          |                                                                           |                  | TC               | √   | 2               | -- | 1 |                                                                                             |
| 3.20                                                                              |            | Vibration test                                                                                | Major | Testing       | One /rating                                          |                                                                           |                  | TC               | √   | 2               | -- | 1 |                                                                                             |
| 3.21                                                                              |            | 120% over speed test                                                                          | Major | Testing       | One /rating                                          |                                                                           |                  | TC               | √   | 2               | -- | 1 |                                                                                             |

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|                                                                                   |                                   |                                                                         |       |               |                  |                                                        |                  |                                                      |   |       |                 |             |  |         |
|-----------------------------------------------------------------------------------|-----------------------------------|-------------------------------------------------------------------------|-------|---------------|------------------|--------------------------------------------------------|------------------|------------------------------------------------------|---|-------|-----------------|-------------|--|---------|
|  |                                   | <b>TYPICAL MANUFACTURING QUALITY PLAN</b>                               |       |               |                  |                                                        |                  | MQP. NO.:                                            |   |       |                 |             |  |         |
|                                                                                   |                                   |                                                                         |       |               |                  |                                                        |                  | REV NO:                                              |   | DATE: |                 |             |  |         |
|                                                                                   |                                   | PROJECT ENGINEERING & SYSTEMS<br>DIVISION BHEL,<br>RC PURAM, HYD-502032 |       |               |                  |                                                        |                  | PROJECT:<br>PACKAGE: <b>MOTOR</b><br>BHEL TECH SPEC: |   |       |                 | PAGE 4 OF 4 |  |         |
| SL NO                                                                             | COMPONENTS                        | CHARACTERISTICS                                                         | CLASS | TYPE OF CHECK | QUANTUM OF CHECK | REFERENCE DOCUMENT                                     | ACCEPTANCE NORMS | FORMAT OF RECORD                                     | * | D     | AGENCY<br>P W V |             |  | REMARKS |
| 4.0                                                                               | <b>PRESERVATION &amp; PACKING</b> |                                                                         |       |               |                  |                                                        |                  |                                                      |   |       |                 |             |  |         |
|                                                                                   |                                   | Painting*,<br>(Shade, DFT,) Marking                                     | Major | Visual, DFT   | Random           | Technical specification/<br>approved drawing/datasheet | TC               | √                                                    | 2 | --    | 1               |             |  |         |
|                                                                                   |                                   | Packing*                                                                | Major | Visual        | Random           |                                                        | Packing List     | √                                                    | 2 | --    | --              |             |  |         |

**Notes:-**

- This MQP should be read along with specification ((Latest revisions to be considered as per PO), approved drawings & approved datasheet.
- Specification/drawing/datasheet shall prevail over quality plan for contradiction if any.
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**Abbreviations:-**

|     |   |                           |     |   |                             |     |   |                    |
|-----|---|---------------------------|-----|---|-----------------------------|-----|---|--------------------|
| MTC | – | Material Test certificate | COC | – | Certificate of Compliance   | DFT | – | Dry Film Thickness |
| TC  | – | Test Certificate          | NDE | – | Non Destructive Examination | IR  | – | Inspection Report  |
| DFT | – | Dry Film Thickness        | IBR | – | Indian Boiler Regulations   | IS  | – | Indian Standards   |

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|                      |                                                                                   |                                                   |                                             |    |
|----------------------|-----------------------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------|----|
| ESP-001-2A<br>Rev.00 |  | <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b> | Std. / Doc. Number                          |    |
|                      |                                                                                   |                                                   | Annexure-5 to Doc. No. PY-AS-4-M096-8371-01 |    |
|                      |                                                                                   |                                                   | Rev. No.                                    | 00 |
|                      |                                                                                   |                                                   |                                             |    |

|                                                                                                                                                                                                                                                |                                                   |  |  |  |
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| <p><b>COPYRIGHT AND CONFIDENTIAL</b></p> <p>The information on this document is the property of <b>BHARAT HEAVY ELECTRICALS LIMITED</b>, It must not be used directly or indirectly in any way detrimental to the interest of the company.</p> | <h1>Annexure-6</h1> <h2>MASTER DOCUMENT LIST</h2> |  |  |  |
|                                                                                                                                                                                                                                                |                                                   |  |  |  |

|                                                   |                      |                     |                      |               |
|---------------------------------------------------|----------------------|---------------------|----------------------|---------------|
| <b>Revisions:</b><br>Refer to record of revisions | <b>Prepared by :</b> | <b>Checked by :</b> | <b>Approved by :</b> | <b>Date :</b> |
|                                                   | Rajeev Jain          | GIRISH              | Siva Prasad Babu     | 27.06.17      |



| MASTER DOCUMENT LIST - Scr |                                                                                                           |                                      |                 |         |                      |                                     |                            |                           |                    |                                                            |    |         |       |    |         |
|----------------------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------|-----------------|---------|----------------------|-------------------------------------|----------------------------|---------------------------|--------------------|------------------------------------------------------------|----|---------|-------|----|---------|
|                            | Vendor Name:                                                                                              |                                      |                 |         | PROJECT:             |                                     |                            |                           |                    |                                                            |    |         |       |    |         |
|                            | Vendor Contact Person:                                                                                    |                                      |                 |         | BHEL PO No.          |                                     | PO date:                   |                           |                    | PO Dly. Date:                                              |    |         |       |    |         |
|                            | Vendor contact No.                                                                                        |                                      |                 |         | Supplier's Job No.   |                                     |                            |                           |                    |                                                            |    |         |       |    |         |
|                            | SYSTEM/PACKAGE:                                                                                           | Screw Sludge Lifting Pump            |                 |         |                      | TODAY-DATE                          | 27/Jun/17                  |                           |                    |                                                            |    |         |       |    |         |
| Sl.No                      | DRG/DOC. NAME                                                                                             | DRG/<br>DOC NO.                      | NO. OF<br>SHTS. | CAT     | CRITICAL FOR<br>MFG? | REQD.FOR<br>CUSTOMER<br>SUBMISSION? | Plan date of<br>submission | Count of DUE<br>as on Dt. | STATUS             | Rev-0                                                      |    |         | Rev-1 |    |         |
|                            |                                                                                                           |                                      | NO.             | (A / I) | (Y/N)                | (Y/N)                               | dd-mmm-yyyy                |                           | " /PV/PB<br>/PC/AA | SD                                                         | AD | APP.CAT | SD    | AD | APP.CAT |
| 10                         | BILL OF MATERIAL                                                                                          |                                      |                 | A       | N                    | N                                   |                            |                           |                    |                                                            |    |         |       |    |         |
| 11                         | BILLING BREAKUP                                                                                           |                                      |                 | A       | N                    | N                                   |                            |                           |                    |                                                            |    |         |       |    |         |
| 12                         | QUALITY ASSURANCE PLAN                                                                                    |                                      |                 | A       | N                    | Y                                   |                            |                           |                    |                                                            |    |         |       |    |         |
| 13                         | SUB VENDOR LIST                                                                                           |                                      |                 | I       | N                    | N                                   |                            |                           |                    |                                                            |    |         |       |    |         |
| 14                         | COMMISSIONING SPARES LIST                                                                                 |                                      |                 | A       | N                    | N                                   |                            |                           |                    |                                                            |    |         |       |    |         |
| 15                         | Mandatory Spares List                                                                                     |                                      |                 | A       | N                    | N                                   |                            |                           |                    |                                                            |    |         |       |    |         |
| 16                         | LUBE OIL SCHEDULE                                                                                         |                                      |                 | I       | N                    | N                                   |                            |                           |                    |                                                            |    |         |       |    |         |
| 17                         | STARTUP PROCEDURE                                                                                         |                                      |                 | I       | N                    | N                                   |                            |                           |                    |                                                            |    |         |       |    |         |
| 18                         | ERECTION PROCEDURE & Comissioing<br>procedure                                                             |                                      |                 | I       | N                    | N                                   |                            |                           |                    |                                                            |    |         |       |    |         |
| 19                         | INSPECTION/TESTS<br>REPORTS/CERTIFICATE                                                                   |                                      |                 | I       | N                    | N                                   |                            |                           |                    |                                                            |    |         |       |    |         |
| 20                         | O& M Manuals(Soft Copies)                                                                                 |                                      |                 | A       | N                    | N                                   |                            |                           |                    |                                                            |    |         |       |    |         |
| 21                         | O& M Manuals(Hard Copies)**<br>** hard copy shall be furnished after getting<br>concurrence on soft copy. |                                      |                 | I       | N                    | N                                   |                            |                           |                    |                                                            |    |         |       |    |         |
|                            |                                                                                                           |                                      |                 |         |                      |                                     | TOTAL                      | 0                         |                    | ^APP.CAT                                                   |    |         |       |    |         |
|                            | A-Approval Category                                                                                       | PV-Commented and pending with vendor |                 |         |                      |                                     | TOTAL "PV"                 |                           | 0                  | A1-'Approved                                               |    |         |       |    |         |
|                            | I-Information Category                                                                                    | PB- Pending with BHEL                |                 |         |                      |                                     | TOTAL "PB"                 |                           | 0                  | A2-'Mfg. Clearance given subject incorporation of comments |    |         |       |    |         |
|                            |                                                                                                           | PC- Pending with Customer            |                 |         |                      |                                     | TOTAL "PC"                 |                           | 0                  | A3-Commented.Revision & resubmission required.             |    |         |       |    |         |
|                            |                                                                                                           | AA- Approved                         |                 |         |                      |                                     | TOTAL "AA"                 |                           | 0                  | A4- Retained for info.                                     |    |         |       |    |         |
|                            |                                                                                                           | " " - Not yet Due.                   |                 |         |                      |                                     |                            |                           |                    |                                                            |    |         |       |    |         |
|                            |                                                                                                           | OD-Overdue                           |                 |         |                      |                                     | TOTAL "OD"                 |                           | 0                  |                                                            |    |         |       |    |         |
|                            |                                                                                                           | " " - Not yet Due.                   |                 |         |                      |                                     |                            |                           |                    |                                                            |    |         |       |    |         |

| Vendor documentation status |                |                               |                            |                             |                                       |                      |                               |                          |                |
|-----------------------------|----------------|-------------------------------|----------------------------|-----------------------------|---------------------------------------|----------------------|-------------------------------|--------------------------|----------------|
| Total No of Docs            | Due as on Date | Submitted by vendor as on Dt. | Approved by BHEL as on Dt. | Commented by BHEL as on Dt. | Pending with BHEL/CUSTOMER as on date | %age of Dos Approved | %age of critical Dos Approved | Is Mfg. Clearance given? | Status/Remarks |
| (Nos)                       | (Nos)          | (Nos)                         | (Nos)                      | (Nos)                       | (Nos)                                 | % age                | % age                         | (Y/N)./ (If Y ) put Dt.  |                |
| 0                           | 0              | 0                             | 0                          | 0                           | 0                                     | #DIV/0!              | 0.00%                         | Y                        |                |

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| ESP-001-2A<br>Rev.00 |  | <b>PROJECT ENGINEERING &amp; SYSTEMS DIVISION</b> | Std. / Doc. Number                          |    |
|                      |                                                                                   |                                                   | Annexure-7 to Doc. No. PY-AS-4-M096-8371-01 |    |
|                      |                                                                                   |                                                   | Rev. No.                                    | 00 |
|                      |                                                                                   |                                                   |                                             |    |

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|                                                                                                                                                                                                                                                |                                                     |  |  |  |

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|---------------------------------------------------|----------------------|---------------------|----------------------|---------------|
| <b>Revisions:</b><br>Refer to record of revisions | <b>Prepared by :</b> | <b>Checked by :</b> | <b>Approved by :</b> | <b>Date :</b> |
|                                                   | Rajeev Jain          | GIRISH              | Siva Prasad Babu     | 27.06.17      |

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List of deviations (expectations and /or addition requested by Bidder) from specification, standards and /or drawing etc.

| Sl. No. | Section / Part/Subsection | Page No. | Clause No. | Bid Specification | Bidder's Query | Purchaser's Reply |
|---------|---------------------------|----------|------------|-------------------|----------------|-------------------|
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|                      |                                                                                   |                                                   | Annexure-8 to Doc. No. PY-AS-4-M096-8371-01 |    |
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|                                                                                                                                                                                                                                                |                                             |  |

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